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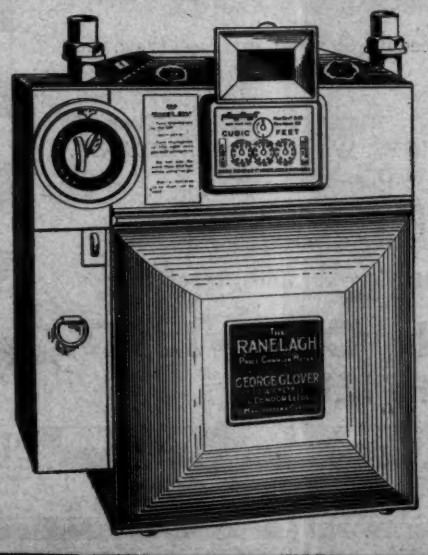

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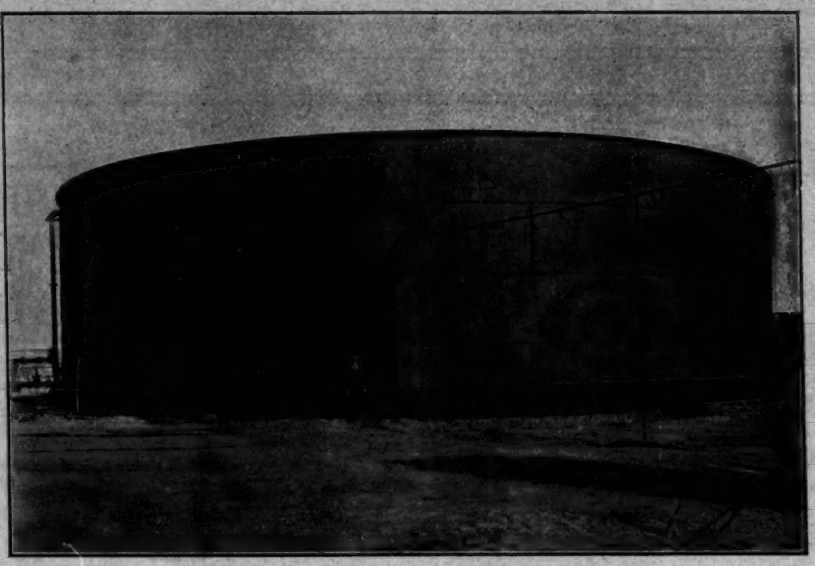

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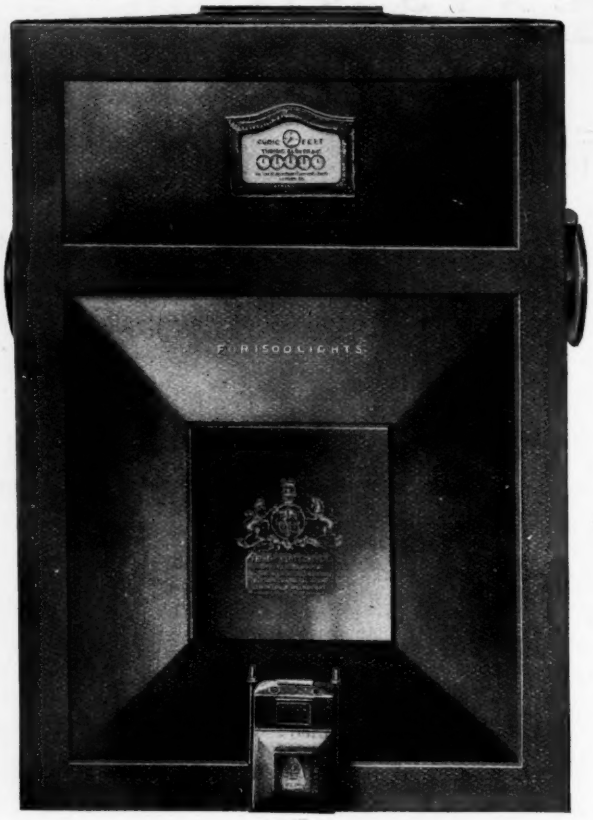

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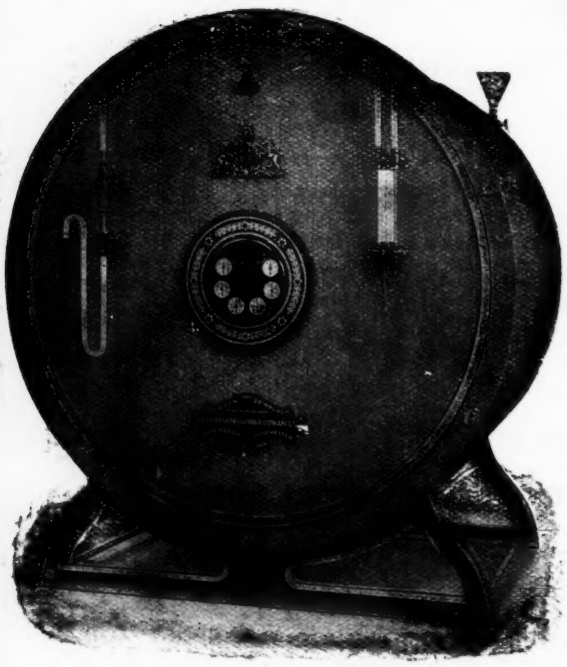

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VOL. CLX., No. 3105.] WEDNESDAY, NOVEMBER 15, 1922. [74TH YEAR.

EDITORIAL NOTES.

Low-Temperature Gas and the Therm.

Too late for any detailed comment, we have received from Mr. George Evetts, Assoc.M.Inst.C.E., an article dealing with Mr. Walter Chaney's contribution to our columns last week on "Low-Temperature Carbonization and the Therm." We are afraid that, in view of this criticism, Mr. Chaney has a somewhat difficult task before him to justify his position. Summing-up Mr. Evett's conclusions, the inference to be drawn may be stated as simply this: Unless the cost per therm of manufacturing gas by the low-temperature carbonization process can be shown to be lower than that of the process it is intended to displace in the case of any gas undertaking, its introduction must not be considered. This is apart from any question with regard to other aspects—for example, the condition of the markets for secondary products.

Enlarging the Basis of the Gas Business in Industrial Areas.

THE paper that Mr. J. Mogford, of Briton Ferry, recently submitted to the Wales and Monmouthshire Institution of Gas Engineers, contains several points which reawaken thought. He entitled the contribution: "Gas Manufacture in South "Wales: Its Past and Prospects." The title localized to some extent what followed; but really much of the subject-matter has a far wider interest. The paper was in effect in two parts. The first section was historical, going back to the beginning of things in gas supply, and associating the Principality with the work of those who laid the foundations of the industry by their pioneering research. The second part, though somewhat fragmentary in character—dealing with many matters in very condensed form—was directed to indicating the ways by which the basis of the business of the industry could be expanded. By looking back, we see how vastly the basis has extended; and as we glance about us, it is seen how enormously it can yet be developed. If those early investigators could now come among us, they would find something over which to marvel. Those beginnings, however, to which Mr. Mogford refers were rather directive than material. Among other work, he alludes to the part which Dr. Watson, the Bishop of Llandaff, had in the research and thought that long preceded the commencement of practical application. He tells how Murdoch endeavoured to interest the Welsh mine owners in the new light. He also shows how Mr. Thomas Barlow, the founder and first editor of the "JOURNAL," actually deprives of originality the proposals of certain respected men who came some time after him, through having pointed out the benefits to be derived "by "sweeping a newly charged retort with water gas, hydrogen, "or other low-grade gas." Mr. Barlow held that this would give an increased yield, and would prevent the decomposition of the hydrocarbons. He also mentioned the disadvantages of over-steaming. He was well before the times of practical application. Bulk supply of gas at the pit-head, too, is not a new idea. About a century ago, Samuel Baldwin Rogers, of Newport (Mon.), spent considerable energy and money in advocating a bulk supply to London from Wales. Apart from this Wales has taken a conspicuous part in the application of gas to metallurgical purposes, as well as in the utilization of blast-furnace and coke-oven gases—the latter not only for industrial, but for town purposes.

While, however, the history of these matters is fascinating to gas engineers, in these progressive times the scope for the expansion of the basis of the business of the industry has even greater interest; and to this end the Gas Regulation Act is a means of incalculable advantage. Few men to-day appear fully to realize the potential value of the Act. The reasons for this are probably and principally found in currently environing limiting circumstances, and in the fact that one's horizon is so largely confined and defined by custom, and the conditions within which one has grown. The idea of constructing new roads to gain fresh territory may occur to some, but the idea very often remains in the incorporeal state, and does not reach any practical form. The whole spirit of the report of the Fuel Research Board on "Gas Standards" (published in 1919) was economic expansion and larger service. Few realize this. Many regard the Gas Regulation Act as simply a means to the end of redressing the wrong done to the industry by the (in changed circumstances) inequitable operation of the sliding-scale, and to enable the institution of the therm, which some appear to think is merely the offspring of cranks. If the Act had done nothing more than introduce the therm, and self-determination by gas undertakings of the calorific value per cubic foot of their gas, we should have said that the measure was a wonderful advance, and opened the door to a larger life in service by the gas industry. The report of the Fuel Research Board indicated that the advisers of the Government in this regard looked upon gas undertakings as the natural centres of labour-saving fuel supply of all kinds and for all purposes—domestic and industrial—in every locality. And at gas-works, in their opinion, the basic material coal should be treated, and the gas or gases be produced there that would serve the purposes and interests of each district. Under section 10 of the Act, very wide powers can be obtained to promote this end. This vision of extended communal and industrial service was not altogether original on the part of the Fuel Research Board. Other men had thought the same before. Power gas clauses had appeared in sundry Private Gas Acts; but there has been little done in that line as the result. Perhaps had the war not intervened and interrupted development, we might already have seen an expansion of the area of the gas business in this direction.

For industrial areas, Mr. Mogford pictures large possibilities. There is the supply of producer gas for steel manufacture and many other purposes. At present this is made in separate private plants, other than in the South Staffordshire Mond Gas Company's area; but he believes that centralized production and distribution would result in a considerable saving of bituminous coal, and be very profitable where metallurgical processes are confined to concentrated areas. This reminds us of the advocacy too by the Fuel Research Board of the supply for industrial purposes of blue water gas (they themselves use it extensively in their heating operations), in view of the fact that it is one of the finest and most manageable of fuel gases for industrial purposes. Then the industry is confronted by the task of producing therms in gaseous form at the lowest possible cost, providing that it is suitable for domestic heating purposes. There is also the expansion into new markets of the principal secondary product; and development in this direction—into steam-raising alone—should, if merit prevailed using suitable equipment, ensure the total absorption of the production. There should be stimulation in all these directions by what Mr. Mogford says. He is living and working in an area where one learns of these things—an area, too, where the activities of an Electric Power Company, and the development of their means of distribution,

cause gas men to try to peer into the future, and to ask themselves how new and keen competition in the smaller towns is to be met. There is likewise the fact that high-priced gas has driven many of the poorer consumers to use oil for lighting; and the sale of oil-cooking stoves has made considerable headway. Gas men cannot afford to allow such competition to go on prospering without making a very serious effort to stem it by offering more effective and equally economic service. The reason that electricity is sold for power and heating at prices below the lighting charges is that it would otherwise stand no possible chance for those purposes. There are economic values for all uses; and the gas industry has to make very liberal study to see how best it can serve the needs of the public, and yet contribute to its own further prosperity in the face of more forceful competition. Our power of competition with electricity and (among the poorer classes) with oil must increase with their advance in competitive power.

The view of Mr. Mogford is that those responsible for the gas undertakings should take into account seriously the question of supplying the gaseous needs of their districts in respect of low calorific power gas for industrial heating and power. Of course, one would have to be satisfied that such business would be commercially sound. But there is the fact that huge quantities of low-grade calorific power gas are used in concentrated areas; so that distribution would not be an insuperable difficulty.

Co-operation in Demonstration.

THERE is no question that we are advancing with excellent effect in our conceptions and execution of what is good and attractive display in demonstrating the virtues of our wares. This is evidenced in the present issue of the "JOURNAL," and in that for Nov. 1. We make no excuse for devoting space to descriptive and illustration work in respect of these examples of progress in the art of demonstration for the purpose of attracting people and educating them in how things should be done, in order to obtain the best combination of artistic effect and utility, at the minimum of expense. Such demonstration as is secured by the flats of the South Metropolitan Gas Company and by the bungalow of the Croydon Gas Company is a presentment of progress of no mean order, and this by means of co-operation. This co-operation is an important feature in the work of local trading effort; and we hope to see a big extension. The proprietors of large local stores where furniture and all else is sold that go to make up the ideal home are as desirous as the progressive men of gas undertakings to draw the public to inspect what can be done. And the public are not averse to going to see something that is an object-lesson in refinement and utilitarian effects. When the demonstration of furnishing is made complete by artistic gas lighting, by the labour-saving means of heating, cooking, hot-water supply for bathroom, lavatory, and culinary and household purposes generally, then what better combination can there be than that the vendor of house furnishings should co-operate with the local gas suppliers in an effort that will draw and interest the public? A house, a bungalow, or a flat is no use with furniture in it, without means of lighting, heating, and cooking; and a house, however well fitted-up with the requisites for lighting and heating, is no good without furniture. Co-operation seems such a natural development in advertisement that the marvel is there has not before this been large adoption. But the fact remains that there has not been, though there should be; and now that a "move is on" in this work, gas suppliers should see to it—before it is too late—that they are the co-operators in this matter, and not their competitors.

The popularity of the flats that have been constructed in large stores in South London is attested by the article in other columns this week, and the same holds good in respect of the bungalow described in our pages on Nov. 1. Both schemes have had bestowed upon them the skill and care of the expert; and the experts on the furnishing side are in their line both artists and masters in the provision of utility, and on the gas side the same may be said. And utility on the gas side has a very broad meaning. It has to be utility compatible with circumstances in respect of the heating, and kitchen and bathroom arrangements—something not in excess of requirements, and yet not underestimated. Also the lighting needs to be artistic, well-placed, and in power not over done nor under done. A great deal of attention is being devoted just now to schemes of installation for household heating by means of gas with the view to efficiency and economy of space; and this is peculiarly necessary in the case of flats and bungalows, with their somewhat restricted accommodation. But it has to be confessed that we have seen some atrocious lighting schemes, in which the designers appear to have little notion as to the fitness of things in respect of artistic fittings, harmony, and requisite illumination for the particular purpose. The science of lighting in many places in the gas industry claims a more extended study than it has yet received. This criticism does not apply to the flats of the South Metropolitan Company, nor to the bungalow of the Croydon Gas Company; but when writing of high-standard demonstration such as we have here, the opportunity presents itself to make the point. In both the flats and the bungalow, the schemes throughout have been planned and executed with a thoroughness which is aptly compressed into a sentence by the member of our staff who wrote the "All-Gas "Bungalow" article published on Nov. 1, when he said: "The most fastidious could take 'immediate possession,' " and find every necessity and luxury at hand." There is no pretence here; it is all real.

No wonder the bungalow at the stores of Allders, Ltd., of Croydon, is so popular, as well as the flats at Messrs. Holdron's, at the Brixton Bon Marché, and at Messrs. Chieseman's in the area of the South Metropolitan Gas Company. In five months, through the flat at Messrs. Holdron's no fewer than 26,000 people passed; and the number of visitors to the other flats has been proportionately good. This shows there is in the displays distinctive attraction—for the goods of the furnishing firms and of the gas suppliers. The settings for the gas lighting, heating, and other gas apparatus are of a character that demonstrate the fitness of these where artistic merit is required, and where utility in the way of economical, prompt, labour-saving service is sought. People will go and inspect in such circumstances where they will not pay a visit to the showrooms of a gas undertaking. There are many things for which they have to go to the furnishing emporium; and there many more people incidentally see and inspect the gas arrangements than would call at the gas showrooms, which, as a rule, they only enter when they have some special need, or are contemplating some new addition to their gas conveniences. The South Metropolitan Company, too, (it is the same at Croydon) have trained assistants in the flats, who are able to give information and register for transfer to the Company's own office any message from a consumer—whether it be an order for new requirement or a complaint. Convenience of the consumer is an important factor in business.

This is all good; and it marks progress at the trading end. In deliberating over the importance of such high-standard demonstration of the co-operative kind, let gas suppliers always remember that it is on the gas sales side of the business that the initial work in the expansion of a gas undertaking takes place. If there is laxity or want of system and lack of effort in maintaining, cultivating, and developing, then the business will practically stand still, or may even show a decline, with active competition from the "other side of the street." The manufacturing end must not have all the ability, system, and science bestowed upon it. Equally important is it to have ability, system, and science directing affairs in and among those resident or carrying on industry in the district.

Value of the Works' Jury System in Preventing Accidents.

CONSIDERING the variety of plant in gas-works and the nature of the operations carried on, it is somewhat remarkable, and a testimony to good management, that, with the several risks, and the high-pressure work during the worst and darkest of the seasons of the year, the number of accidents—fatal and otherwise—to workers in the gas industry compares as favourably as it does with the number occurring in less hazardous occupations. Mr. R. C. Macdonald, the Mechanical Engineer of the South Metropolitan Gas Company, was dilating upon this subject the other evening at a meeting of the London Area Committee of the British Industrial "Safety First" Association. The salient feature of what he had to say related to the three-decade experience of the jury system of inquiring into accidents at the stations of the South Metropolitan Company. The results have shown that the institution of

that system has been highly valuable in several ways. The jury consists of twelve workmen—presiding over them the chief officer of the department concerned. In the case of a fatal accident, the President of the Company presides. Witnesses are examined by whoever is in the chair; the members of the jury ask questions; and any plant or machinery involved is inspected. At the end of the inquiry, the jury answers a set series of questions, as reproduced in the notice of Mr. Macdonald's lecture in our news columns. Put briefly, the object of the inquiry is to ascertain the cause of the accident; and whether there was any carelessness, negligence, error, or misconduct. The whole of this aims at the prevention of accident—in fact, one of the questions is "Can anything be done to prevent a similar accident?" This is perhaps the most useful of the several issues of the system, as it has produced some very valuable suggestions from men in daily and hourly working contact with the place and plant where the accident occurred. These suggestions are always carefully considered, and, when found practicable, are adopted. The jury's verdict is posted in the works. The figures that Mr. Macdonald gives show that, during the period of the working of the system, the percentage of accidents has been considerably reduced. The percentage is based on the number of men employed. During the period of thirty years, the business has increased enormously; and if the number of accidents was tested in relation to a given unit of business done, we should not be surprised to find that the number would be even more favourable than as based on the aggregate of workers. As it is, the reduction of the percentage figure is very favourable and gratifying; and it speaks well for the jury system of investigation, with the object of doing the utmost to eradicate the chances of accident. There is a point about the percentage of accidents that is very notable. It is that when, during the war, there had to be imported workers, the percentage went up. This shows that skill and experience have their bearing on the question of accident, and so has the *morale* of the men; and this the conditions at the South Metropolitan Gas Company's works tend to elevate. There is another valuable issue to this jury system. It is that it gives the workers confidence that all possible is done for their protection. The knowledge that causes of accidents are investigated by a jury of their own body, that the plant is periodically inspected by the jury, and that suggestions for the prevention of accidents may be made, must all promote confidence and satisfaction. It is an excellent system. Nothing should be left undone that can be done to prevent accidents on works, and to give the workers the largest measure of assurance that their duties are being carried on under the best possible conditions of safety. In this regard, long experience speaks well for the jury system of accident investigation.

The Capital Levy.

THE plans of the Socialistic Labour Party for readjusting the finances of the country (with a somewhat nebulous purpose, but one strongly suspected of being revolutionary) have been kicked, pummelled, and denounced (save by the socialists themselves) freely from platforms and industrial and financial quarters. This especially applies to the capital levy—that is, a levy on all individual capital holdings above £5000. The plausible suggestion is that the proceeds are intended to reduce the nation's war debt. But these wonderful amateur financiers who would take this short-cut to quite an excellent goal appear to be oblivious of the fact (but, of course, they are not) that by their method they would be depriving the country of much of its industrial vitality, which would certainly result in increased unemployment, and a shrinkage of the taxable basis of the country. They would give relief on the lower incomes and reduce the tax-paying capital at the other end; and so our fiscal resources would be gravely diminished. Of course, this does not matter to the socialist; his policy aims at subversion and disorder.

In the "Evening Standard," Sir Arthur Duckham, K.C.B., and in the "Financial Times" Mr. Harold Cox, have been writing on this subject of the capital levy, which has equal concern for every employee and every capital holder in industrial or trade enterprise of any kind. Both authorities, writing simultaneously, point to the same effects, and arrive at the same conclusion as to the objective of the authors of the scheme. They both mention, in different ways, what is manifest—that anything which reduces the capital of the country means increased difficulty in financing industry and commerce. This must reduce the earning power of the country; and therefore employment and the capacity of industry to pay wages would be hit very seriously. The reverse conditions have the opposite effects. As Mr. Harold Cox puts it, as capital is increased, so the efficiency of industry grows; and this enables each individual worker to produce more wealth, as well as enlarges the aggregate number of the workers. Furthermore, when these financial amateurs talk of increasing taxation on the larger incomes, they conveniently forget that a not inconsiderable part of the incomes of people are put by, and utilized for capital purposes; and this tends to cheapen capital in the market, which is a factor in the prosperity and expansion of industry, and therefore of employment. The growth of employed capital means a growth of the amount distributed as wages; a diminution of capital means a decrease of wages. These are economic platitudes; but they are all true.

The ostensible object (though not the actual one) of the capital levy as proposed by the socialists can be better served by doing those things that will assist and not hinder industry in its development. A capital levy would have the latter effect. It would worsen and not improve matters; and it would increase the disordered state of affairs which, at the present time, is responsible for so much unemployment. Instead of a capital levy, as Sir Arthur Duckham says, though not in these precise words, what is wanted is the whole-hearted co-operation between capital and labour to lift the terribly heavy millstone of debt that is about the neck of the country. But the extremists do not wish for co-operation. Disorder and revolution are the capital stones of their political edifice.

A Notable Length of Service.

Is Mr. William Garlick, of York, the oldest gas-fitter still on active service, and does he hold the record for length of service? His age is 89; and he has completed 75 years of gas-fitting work for the York Gas Company. If anyone has a superior record in the gas-fitting line, we should be pleased to hear from him. Perhaps Mr. Garlick should now give up work. But, knowing the York Gas Company, we have no doubt it is a fair surmise that it is Mr. Garlick's own fault that he does not; and we venture to say he would not now know what to do with himself without something in the nature of a job. We give his photograph in our news columns to-day; and if facial appearances go for anything, then Mr. Garlick does not betray in his features much need for him to argue over the question as to whether it shall be light work or unoccupied days. However, we congratulate him upon his record, and upon the physical excellence that has enabled him to give such a length of service. Everybody in the Company seems to be proud of "William"—from Directors downwards; and on his seventy-fifth anniversary of service (by the way, under half-a-dozen managers), they met together, and made presentations from the Board and various sections of the staff. If all the good wishes that were expressed to him on the occasion are fulfilled—well, Mr. Garlick will add many years to his account. The length of service tells us two things—that Mr. Garlick has been a faithful servant, and that the Company have not been bad masters.

The Smoke Abatement Bill.

The Smoke Abatement Bill which the late Government introduced as a result of the report of Lord Newton's Committee on the subject of the abatement of smoke and noxious vapours, appears to be absolutely friendless, and is regarded as a contemptible weakling. With the change of Government, it is hoped that there will be no attempt at its resuscitation in the form in which it was introduced, but that something better will emerge. This "something better" should make a start in some way with domestic fires, which investigation shows are responsible for about four-fifths of the contamination of the atmosphere. Nobody likes the Bill. Lord Newton himself has expressed his disappointment with it; industry is opposed to it as being unfair; the industries supplying smokeless fuel regard it as a stupid production, and look upon it as a feeble reply to a report that aimed, if it did not very well succeed, at being constructive; and now we see that the chemists are hostile to it in that it has no bearing whatever upon their work, while naturally the proper treatment of coal, instead of its crude destruction, is a matter of great importance to them. The question was referred to in an address by the

President of the Society of Chemical Industry (Dr. E. F. Armstrong, F.R.S.), at the opening meeting of the London Section. The road to smoke abatement, in his opinion, lies with low-temperature carbonization. Perhaps it does partially; but the major part in smoke abatement will be taken by piped fuel, and not fuel conveyed over the surface of roads, and which requires storage and handling in the household. This is the view of Mr. E. V. Evans (Chairman of the London Section). He recognizes that there will always be a demand for solid fuel. He feels, however, that "it was useless for a Committee to make recommendations which might handicap the progress of industry, when four-fifths of the trouble arise from the domestic grate." In his view, "chemists have not yet supplied the public with anything that is suitable, or in sufficient quantity, which will allow them to burn fuel smokelessly, except coal gas."

London's Greatest Scourge.

There is a readable little article in the current issue of "The World's Work," by Jasper Lockett, on "London's Greatest Scourge, and the Remedy." The scourge is the air-polluting smoke, which forms a pall between humanity and the full beneficent effects of the sun's rays, and does other incalculable destructive mischief. The writer compares the conditions of London and other large cities with those that obtain in several imposing cities abroad; and he holds that a clean and healthy London, Birmingham, and Liverpool is not a fantasy, a dream—it is possible of realization. It is criminally wasteful, the writer submits to burn smoke-producing coal in the open grate. It is quite true, that such huge strides have been made in the science of heating that it is possible for every citizen to take advantage of them if he chooses. But the average householder does little to overcome the drawbacks of his home, and goes on using wasteful coal fires, with all the attendant labour, apparently oblivious of the fact that gas and electricity are available. It is amusing to see electricity mentioned in connection with general heating, when one considers the inefficiency of the process of converting coal into electrical heating energy, and then the further loss there is in most purposes of utilization. Mr. Jasper Lockett thinks that, in conjunction with a simple and inexpensive system of central heating, an electric fire offers unchallengeable economy. This is a strange notion. On the one hand, the writer wants the radiant effects of the sun, now largely depreciated by smoke, to work their health-promoting ways. Inside the house, he wants largely to abolish radiant heat, and to put in its place convected heat of a central heating system. And so our popular advisers proceed!

Gas Coal Position.

The situation last week in respect of the gas-coal markets was simply a continuance of that which obtained in the previous week. Fogs, rapid incoming of cold and wet weather, and the longer hours of darkness, are combining to exert pressure on the gas undertakings of the country; and this is being reflected everywhere by the views of gas managers—not only as to current requirements, but as to the extent of stocks that should be carried to create comfortable conditions. Particularly in Durham and Northumberland, there is not much gas coal available for the open market. There is rather more elsewhere; but, generally speaking, the coal on offer is of the second-class sorts.

Price of Synthetic Nitrogen Products.

Under Government control, Germany is proposing to import 200,000 tons of Chilian nitrate for the coming season; and a scheme for financing is under consideration. In their customary circular, Messrs. Aikman, Ltd., comment upon this, and then mention that a further increase in the price of German synthetic nitrogen products was announced on the 1st inst.—nitrate of soda being raised from M.359·30 to M.576·10, sulphate of ammonia from M.297·90 to M.477·60, and cyanamide from M.265·10 to M.425—all per unit of nitrogen per 100 kilos. Owing to continually increasing costs, one syndicate are now only selling their production a month ahead; and up to the present, demands from consumers have greatly exceeded the quantities offered for sale. The total production in Germany for the year ending May 31, 1923, is variously estimated at 320,000 to 360,000 tons of nitrogen; but owing to the scarcity of soda, the output of nitrate of soda is understood to have been reduced to about 12 p.ct. of the total production of nitrogen.

Shrinkage in Trade Union Membership.

The trade unions are passing through bad times. There is a serious falling-off in membership. Many of them are sadly crippled in respect of funds, owing to the destructive policy of *post*-war years. The declension of membership means not only a reduction of income, but of the representative power of the leaders. In his quarterly report, Mr. W. A. Appleton, the Secretary of the General Federation of Trade Unions, comments on the reduction of membership. The continuance of defections, he says, is causing anxiety. That there has been serious loss cannot be gainsaid. The teaching and practices of the past few years have tended to weaken the principle of collective bargaining in matters relating to wages, hours, and conditions. Faith in the methods sanctified by the struggles of the pioneers of trade unionism has been lost. It has seemed easier to use force than reason; reason is still the better weapon. The laws which govern production and trade are very delicately poised. They may be easily upset; but they can never be definitely overborne. When reason is brought to bear, modifications of these laws may be attempted; but when force is used, or when the power of the trade unions is applied to other than trade union purposes, disaster may be expected.

PERSONAL.

Mr. J. W. MEARNS, of Banbridge, has been appointed Manager of the Newry (co. Down) Gas-Works, out of thirty applicants.

Alderman J. H. LLOYD has been re-elected Chairman of the Birmingham Corporation Gas Committee—a position which he has held for many years.

Councillor WILLIAM CUNDIFF, the new Lord Mayor of Manchester, is Deputy Chairman of the Gas Committee, and is connected with other important business enterprises in the city.

In the list of Dissolution Honours published last Saturday, we were pleased to see the name of Sir EDWARD A. GOULDING, Bart., M.P., a Director of the Continental Union Gas Company, Ltd., who has been raised to the Peerage.

The advertisement for Assistant to the Managing Director (Mr. Norton H. Humphrys) of the Westbury Gas-Works, Wilts. in our "Situations Vacant" column, elicited sixty-nine replies. Mr. WALTER J. ALLEY was the selected candidate.

Alderman A. W. WALL, the Chairman of the Buxton Gas Committee, has been unanimously elected Mayor of the borough for the second successive year. In returning thanks for his re-election, Alderman Wall said it had been his privilege to announce during the past year two reductions in the price of gas; and it would be gratifying if he had the same happy experience in his new term of office.

American v. European Coke-Oven Practice.

Some criticism of European coke-oven practice has been offered by Mr. Joseph Becker, of the Koppers Company, Pittsburgh, in a paper read by him at Buffalo. He declared that American bye-product coke-oven practice leads the world to-day, in spite of the fact that the bye-product coke-oven was in general use on the Continent before it was even considered in the United States. In fact, from the standpoints of output per oven per day and quality of product, he is convinced that European practice is at least ten years behind that of America. He asked why it is that modern American ovens carbonize more than double the quantity of coal per day than can be coked in ovens as built in Germany and England, and expressed the opinion that this great difference in coking speeds is not due to the coals employed. To his mind, one reason for Europeans not being able to attain American coking speed is that they generally do not use silica construction; but, on the other hand, there are ovens of this material in Europe which have not reached anything approaching American practice. Mr. Becker expressed the opinion that the difference in capacity of the American ovens as compared with those in Europe is due entirely to the use of properly manufactured silica material throughout, combined with better design, and last, but not least, better operating organizations and more systematic operation. Another point in connection with the matter which was emphasized by the author was that, notwithstanding the rapid operation prevailing, the bye-product yields in the United States are fully equal to those obtained in Europe.

How to Form a Company.—The commercial publications of Messrs. Jordan and Sons, Ltd., of Chancery Lane, W.C. 2, are well known; and their wide appeal may be judged from the fact that "How to Form a Company," by Herbert W. Jordan, has recently reached the fifteenth edition. A sub-title has been added which reveals the nature of a great part of the publication: "An Explanation of the Documents filed on Incorporation, and the Principal Statutory Requirements affecting Companies." This and Messrs. Jordan's other books are invaluable to any prospective promoter or official of that somewhat involved incorporation, the limited company. The price of the book is 1s. 6d. net, or by post 1s. 9d.

ELECTRICITY SUPPLY MEMORANDA.

THE second conference of electrical salesmen in London was on the subject of small electric heaters and cookers—that is to say, the domestic variety. The paper was by Mr. R. Smith, and the Chairman was Mr. L. L. Robinson, of Hackney. Neither the paper nor the discussion helped to serve up anything new on the subject. The weekly journals applauded; but really we fail to see that anything was said that has not been said before. Perhaps we ought to omit from this a remark by the Chairman, that technical matters and trade squabbles should be shunned. That is new in such discussions. Trade squabbles refer to prices, trade discounts, and so on. As a matter of fact, these technical and price questions have a great deal to do with the work of the salesman. They are really imposing factors. But apparently the less publicity that is accorded them the better from the electrical standpoint, as it gives people less to talk about; and perhaps it is a pity to keep reminding the competing gas salesmen of the technical troubles there are with electrical apparatus, and of the high costs of both installation and appliances. But all attempts to hide them must fail. Experience does the advertising; and electrical men know this. It is easy enough to get some users, when appliances are new, and before the novelty wears off, to speak in praise of them. But the electrical salesman, despite a few useful testimonials, finds in the direction of subjects that were banned at the conference certain perils to easy-going work. Mr. Robinson said that one of the important things to discuss was, how to awaken general interest in the goods the salesman has to sell. One way to awaken general interest is to be able to show that the goods are cheap. Can the electrical salesman truthfully do this? Of course, he cannot. Can he say that electric heaters and cookers are uniformly reliable, and do not depreciate in efficiency? That depends upon his veracity. Another point was how to keep the interest awake. That is highly important. To keep the interest of the public awake, there must be such experiences that they alone will be an aid, and not a drawback to the salesman. Other points were, how to approach the consumer, how to convince him, and how to secure his order. The reports of the discussion do not show that these aspects of electrical salesmanship were treated with any vigour. As a matter of fact, they were hardly touched upon; when they were, it was quite incidentally. The lead of Mr. Robinson sadly missed the mark.

Important Factors Banned.

In the paper one feature was that Mr. Smith tried to show that there was a cost equality between electricity and gas for heating purposes. In this he signally failed, either through ignorance or deliberate intention. He took as his comparison a 30 c.ft. gas-fire and a 2 KW. electric-fire, and assumed they have equality in heating power. Why he did this, nobody who can distinguish facts from assumption can explain. But he pointed out that a 30 c.ft. fire with 500 B.Th.U. gas would expend 15,000 B.Th.U. per hour. With the therm at 1s., this would mean rather less than 2d. per hour. In London, a therm costs 10d. to-day; in some other places 9d., down to 6d. So where the price is below 1s. his comparison will not apply. For the electric fire, he takes electricity at 1d. per unit, while it is 1½d., 2d., and 2½d. in not a few places. Therefore local prices considerably affect the question. Why he took 1s. per therm and 1d. for electricity is not clear. The next point is as to why he compared a 2 KW. (6840 B.Th.U.) electric-fire with a 15,000 B.Th.U. gas-fire. Assuming 100 p.ct. efficiency for the electric-fire, and so magnifying its heating capacity, it would throw into the room 6840 B.Th.U. The 15,000 B.Th.U. gas-fire would (giving 50 p.ct. radiant heat and 25 p.ct. convected) transmit to the room 11,250 B.Th.U.—*i.e.*, 4410 B.Th.U. more. Allowing 75 p.ct. efficiency for the gas-fire, a fraction of over 18 c.ft. of 500 B.Th.U. gas (or 9120 B.Th.U.) would throw into the room the same quantity of heat as the 2 KW. electric-fire. That 9120 B.Th.U. would, at 10d. per therm, cost less than 1d. per hour. What has Mr. Smith to say for the integrity of his comparison? It was remarkable how few of those who discussed the paper had anything to say on this subject of relative cost for heating. The 2 KW. fire would cost, where electricity is 1½d. per unit, 3d. an hour; where 2d. per unit, 4d. per hour. Another point is emphasized by a correspondent of the "Electrical Review." It is that the cost of wiring a heating point in many houses where lighting is already installed is prohibitive, and frequently more expensive than the actual fire. If, he remarks, this item of expense were not present, the demand for electric-fires would be much greater, as there are a vast number of cases where the deciding factor for not installing electric-fires is the cost of wiring.

Comparisons with Gas for Heating.

It is as obvious as anything can be that, as the heating load attains its highest point in winter, it synchronizes with the period of greatest demand on the generating plant and cables for lighting. Well now, Mr. Smith says that, whatever may be the effect of radiators on the peak load during the cold snap (winter temperatures are something more than a "snap"), the station engineer has almost an ideal field before him in electric cooking. The station engineer wishes that all the conditions associated with electric cooking were of an "ideal" character, to enable him to take possession of the "ideal" field. In this respect, according to Mr. Smith, the public only require hiring facilities and reasonable charges to enable the engineer to get this valuable load. There he is "talking through his hat." Hiring facilities and reasonable charges are not the only points; electricians are well aware of this. Then we get another loose statement. He says it is a "general experience" among users of electric-cookers that the cost is only little more than one-half that of doing the work by gas. It is not a general experience; and such a general statement one does not expect from a technically trained man, though from electricians one often has examples. More precision is looked for. What is comprised in the cooking, the relative cost of which is as one-half for electricity to one for gas? Not a word of explanation. Reading through the paper and the discussion, the impression one gets is that it is a work of art to learn to manage electric-cookers, so as to obtain the utmost economy from them. Consumers should be taught how to manage electric-cookers. That is a very proper thing to do. But an electric-cooker in its constitution is not an embodiment of simplicity such as is a gas-cooker; and there are elements about them which go wrong and deteriorate. Then household work is not, as a rule, carried out with scientific precision. Particularly is this so with work that is done on the hot-plate of either an electric or a gas cooker. It seems that, to secure any economy at all with an electric-cooker, one must study infinitesimal detail, and operate accordingly. One should, so Mr. Smith says, only boil the exact measured quantities of water required. Well, householders will say to this: "We cannot be bothered." To obtain maximum economy, he advocates that a separate electric-kettle should accompany every electric-cooker. He also advises that the residual heat of the hotplate should be used to prepare water for washing-up purposes. There should also be good drilling of the consumers in the use of the switches, in order to give as required full, one-half, or one-quarter of the total consumption of the element. In the discussion, one speaker suggested that the heating business could be looked after by the contractors, but the cooking business requires careful handling by the supply authorities. Another urged that demonstrations should be regarded as an essential part of propaganda work.

Careful Cooker Nursing and Economy.

It really seems that the first thing required in the electric cooking business is a campaign among the salesmen themselves; for there is quite a unanimous expression of opinion in certain electrical quarters that electrical salesmen are the last people in the world who would even dream of using the cookers they are paid to advocate. At the conference, the point was made. It was urged that every seller of electric-cookers should have one in his own house, so as to get to actual facts as to costs, labour-saving, and so on. We think it is very likely that electrical salesmen cannot afford to have these goods, so that they cannot get the experience. The point was made that salesmen should be imbued with the idea that they are selling the finest possible article, so that they can impress their customers with what they are going to get out of it. The Hotpoint Electric Appliance Company want to take part in this work, and incidentally, we suppose, to get a good advertisement for themselves. They have arranged to supply, on special terms, a cooker for personal use to men within the industry, in order to encourage them to take up electric cooking, and so obtain first-hand knowledge. We give the Hotpoint people credit for a smart piece of work. Commenting on the offer, "Electrical Industries" says that, curiously enough, the people inside the industry are more critical of electric cooking than the general public. They have better knowledge than the general public as to why they have cause to be. Our contemporary emphasizes the point by saying that "the attitude of the average consumer of electricity towards electric cooking has been a little more receptive than that of the average electrical man." It is added that, in selling an electric service, a man is at a great disadvantage if in his daily life he ignores that service. Of course, he is. But to get personal knowledge, the electrical salesman should have financial assistance from his undertaking. Returning to the conference, we are glad to observe that a speaker urged that one of the traits of electric salesmen should be straightforwardness.

Salesmen Not Electric-Cooker Users.

There is an interesting series of articles running in "Electrical Industries" on the "Design of Electrical Appliances." The second of these articles deals with "Water Heating by Electricity;" and in this the author (Mr. R. Gillespie Williams) treats of the good and the bad points of different appliances—that is, as he sees them. He urges the need for some cheap method of putting power wiring into houses. There are difficulties. One is that such a large portion of the middle class rent their houses, that they do not feel inclined to go to the expense of wiring for the landlord's benefit when they leave. In his view, too, another great drawback to the whole domestic electric appliance trade is the lack of some systematic and sliding rate of charges for the supply of electricity. We agree entirely with the author that, if electricity is to become a universal power in the household, there should be efficient means of heating water both

Water-Heating Appliances.

quickly and in quantity by electrical appliances. That statement appears at the beginning of the article. At the end, it is stated that, with electricity at 1½d. per unit, a good hot bath may be obtained for the sum of between 4d. and 5d. in about three-quarters of an hour. The writer says "this compares favourably with all non-electric methods, and in addition is unrivalled in ease, convenience, and cleanliness." This is really humorous, and it is sheer nonsense. Fancy having to pay for a bath (110° Fahr. is considered by the author higher than most people can stand) between 4d. and 5d., and have the inconvenience of waiting three-quarters of an hour for it! Householders accustomed to the promptness and cheapness of gas heating would smile hugely at Mr. Williams' idea of "favourable comparison." The writer of these "Memoranda" gets with a geyser a good bath in about eight minutes for an expenditure of 2d., in a district where the price of gas to-day is far ahead of what it was before the war. Dealing with the heating of small quantities of water, experiments have proved that the highest efficiency is obtained by immersion heaters; the efficiency as compared with other methods being between 10 and 25 p.ct. higher. But there are drawbacks to immersion heaters. One is that the elements must always be kept immersed or partly immersed in the water, else they tend to burn-out. This, he said, has led to the fixing of the elements to the lid of the utensil—a method which has not proved entirely successful. The author admits that it is a clumsy arrangement, on account of the flexible wire connection; and the wire gets wet with the steam, or burnt by resting against the hot sides of the kettle. This means continual trouble. At the same time, he is an advocate of semi-immersed elements, and for this reason: Time is an important factor; and "quick heating of water is not an outstanding feature in electrical appliances." We are pleased at the candour of this writer, which is so very unusual in the electrical papers when dealing with this subject. Thus it is that the writer agrees that the system that enables a kettle to boil in eleven minutes instead of fifteen deserves a wider application than is at present given to it.

Landlords and Assisted Wiring.

Tenants have an objection to pay for something that will eventually become the property of landlords. At a recent meeting of the Gravesend Town Council, some of the members showed great hostility to a proposal to adopt an assisted wiring scheme, for which £500 had been set aside by the Electricity Committee. The idea is that householders should pay an extra 2d. per unit until the cost has been liquidated. The view of householders was voiced by Alderman Huggins, who stoutly asserted that he for one would not pay the extra price per unit for something that would eventually become the property of the landlord. The matter was not carried forward, as it was ruled that there was no proposition before the Council.

Lighting Installation Estimates.

The considerable differences that one often sees in estimates for electric lighting installations has been the subject of an article in the "Electrical Review" by Major J. C. Connan. The wide differences appear to be very much accentuated at the present time. The writer gives the lines on which an estimate for a lighting installation may be prepared; but we will not touch upon them, contenting ourselves with a reference to the general remarks in the opening of the article which indicate the causes for the large variations. Some people seem to think that these are due to a few reasons, whereas they are greatly influenced by quite a number. It is also pointed out that, even where specifications and bills of quantities are supplied, there is still left plenty of scope for difference between the final tenders. Then where there are so many different types of material required, supplied in such great variety by so many competing firms, and few of them made by the same manufacturer, it is extremely difficult to obtain a consistent quality throughout the installation. However, Major Connan says that, by a careful selection of the samples before placing the order, and rigid inspection during the erection, a high-class installation can be obtained; and no doubt, if this procedure were always strictly applied, a much higher quality of estimate would be put forward, and consequently a smaller range of price difference would result. Perhaps! Competition and the availability of a wide variation in the quality of materials make a considerable difference.

The Thomas Hawksley Lecture will be delivered by Dr. T. E. Stanton, C.B.E., F.R.S., at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W., on Friday, Dec. 1, at 6 o'clock. The subject will be "Some Recent Researches on Lubrication."

At the opening of the session of the Institution of Civil Engineering, Ireland, Prof. Pierce F. Purcell, the President, referred to the tendency to call in engineers from outside when any work of importance had to be undertaken in Ireland. He said this could not conduce to self-reliance or initiative in the development of national resources, and pointed to the strong stand made by Canadian engineers against a similar practice. As a result, Canada now had some of the most highly qualified engineers in the world, and all the great constructional work there was the product of Canadian engineering skill.

SMOKE ABATEMENT.

At the Opening Meeting of the 1922 23 session of the London Section of the Society of Chemical Industry, on Monday of last week, Dr. E. F. Armstrong, F.R.S. (the President of the Society), gave an address in which he dealt with a number of problems in the chemical industry. He pleaded for combination and co-operation among chemists and engineers for a high standard of attainment and professional etiquette, honest dealing with the public, and clearness of thought and expression between chemists. Chemists, he said, had not yet taken the place to which they were entitled in the affairs of the nation, and it was only by treating the public honestly, and making themselves understood, that they would reach that position.

Among the subjects referred to was that of smoke abatement and low-temperature carbonization. The Smoke Abatement Bill was presumably, he said, based upon the report of a Commission and reports of Committees, and investigations undertaken by a great number of men who had long made a hobby of this particular question. The researches of these people, however, had proved that four-fifths of the smoke nuisance in industrial centres and great towns was due to the domestic fire; but the Bill did not mention the domestic fire. All the Bill did was to select the poor manufacturer, because the manufacturer was a most unpopular person at the present time. He was the goose that laid the golden eggs; and right from the earliest days of fairy tales the goose was marked for destruction. He did not think it was the fault either of the householder or the manufacturer that smoke was made. The fault was that the State did not have a little more control over new buildings. If they were to solve a problem like this, they had to put the blame further back than they had been in the habit of doing.

Commenting upon the activities of the Fuel Research Board, Dr. Armstrong said the Board had recently issued two reports of very great value. One was on the use of low-temperature coke; and it was very satisfactory that the Board had taken up a problem of this kind. The other report which he had in mind was one in which various types of stoves were dealt with scientifically. Surely, if any one of them managed to save up enough money to get a new stove in these hard times, it ought to be possible to obtain one which was really made scientifically. They wanted a little more help in the fundamentals; and he pleaded for some more active form of co-operation between chemists and engineers, so as to get these fundamental problems solved.

It was really a disgrace to our civilization, and particularly in this country, that we lagged behind. If any one really wanted to get something up-to-date, and had been sufficiently cosmopolitan to go about the world, he would never buy anything in this country. They did not seem to worry enough about the scientific fundamentals. Why was it the engineer and the chemist did not appreciate one another somewhat better in these matters? He believed, in the long run, that one of the greatest advances the Society had made during the past five years would be found to be the Chemical Engineering Group, because that Group was very earnestly and sincerely trying to bring chemists and engineers together in these common problems.

DISCUSSION.

Mr. E. V. EVANS (Chairman of the Section), speaking on the question of smoke abatement, said he was of opinion that Lord Newton's Bill was a little premature. As a chemist retained by a gas company to advise them, he knew of a very valuable smokeless fuel. At the same time he was aware that distillers of coal to-day were beginning to realize that there must always exist a demand for solid fuel in every house, at any rate during the present century; and though he was very appreciative of what coal gas could do, solid fuels were really required at certain points. There was no reason, however, why in the future there should not be an admirable solid fuel which would not be as expensive as coal. He felt that, though they wanted smoke abatement, it was useless for a Committee to make recommendations which might handicap the progress of industry, where four-fifths of the trouble arose from the domestic grate. Yet they as chemists had not as yet supplied the public with anything suitable or in sufficient quantity which would burn smokelessly, except coal gas.

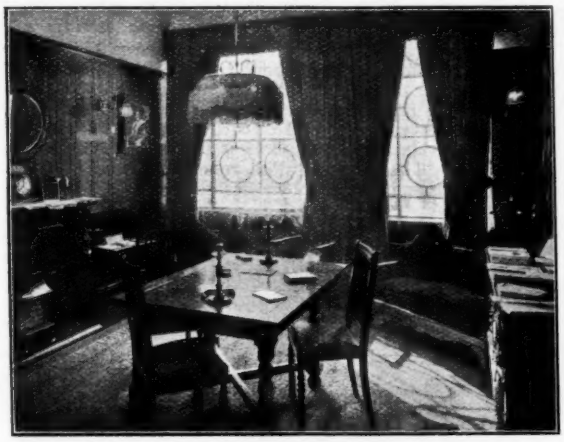
Mr. WALTER REID said the next Smoke Abatement Bill would be a very different measure. The difficulty had been that those responsible for drafting the last measure did not put into it what they were urged to. The difficulty was to get people to do away with the open fire; and another difficulty, from the manufacturer's point of view, was the definition of smoke in any Act of Parliament. Hitherto the definition had been "black" smoke; but there was no black smoke, and convictions had been obtained by stretching the meaning of that definition. That, however, would be altered, and there would be some tests given which would be useful both from the point of view of the domestic user and the manufacturer. He had been interested in this question for some years, and claimed that the work that had been done had resulted in the reduction of fogs in London to a fraction of what they were.

Mr. W. J. U. WOOLCOCK said that the Smoke Abatement Bill which was introduced last year by Lord Newton was dead; and it was the most stupid Bill that had ever been introduced which had any bearing upon chemical industry.

Yorkshire Junior Gas Association.—The next meeting of the Association will take place in the Bradford Corporation showrooms, Darley Street, on Saturday afternoon of this week, under the presidency of Mr. H. L. Bateman, Wakefield. Mr. H. Wilde, of Bradford, will read a paper on "Salesmanship and Service."

WORK-MADE-EASY FLATS.

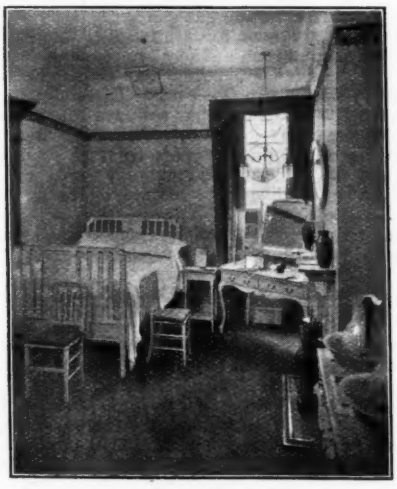
These are words which should appeal under prevailing conditions, perhaps more forcibly than ever before, to the harassed housewife; and experience of their proper use has proved abundantly that they do so appeal. About six months ago, in co-operation with Messrs. Holdrons, a big firm of retail furnishers and drapers, of High Road, Balham, the South Metropolitan Gas Company inaugurated a scheme for demonstrating to the public by the aid of a model flat on the firm's premises the labour-saving and other advantages of gas. So well had everything been thought out and arranged that the venture proved an immediate success—and a lasting one; so that it was not surprising to find



The Dining-Room.

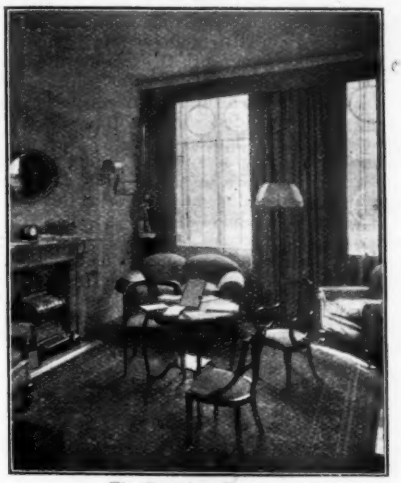
the original installation followed three months later by another at that well-known shopping centre the Bon Marché, Brixton Road, and again more recently by a third in connection with the business of Messrs. Chieseman, of Lewisham. The results that have accrued to the partners in these co-operative arrangements justify the confident anticipation of further developments in other quarters. During the first five months, careful records showed that no fewer than 26,000 people passed through the flat at Messrs. Holdron's; and though a similar check could not conveniently be made in the other cases, it can be said that the attendances have been proportionately good.

In each of the instances named, the flat is situated in a prominent part of the furniture section of the premises, so that the greatest possible amount of benefit from the displays may accrue to the firm concerned, by whom the flat is completely equipped with modern furniture, to represent absolutely inhabitable rooms. The furnishing and the accommodation are the firm's contribu-



The Bedroom.

tion to the scheme of co-operation. On the other side, the South Metropolitan Gas Company, from their large and well-trained staff, supply expert women to interview visitors and explain the various appliances. The definite results are that the retail firm are able to display furniture under such realistic and attractive conditions as lead to very satisfactory sales; while the Gas Company have found a very pleasant means of getting into closer touch with their consumers. As a matter of fact, the whole business of the Company in relation to the consumer can be carried out in these flats, with the exception of the taking of accounts. Complaints, for instance, can be handled as expeditiously there as anywhere else, and advice on any matter desired can be given. In short, a unique opportunity is presented for cultivating goodwill. People will go into these big emporiums who might not take the trouble to visit a formal showroom; and then, of course,

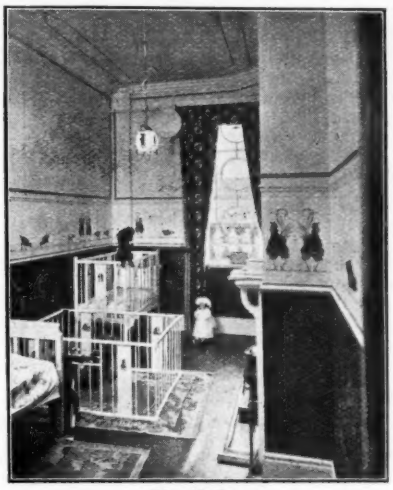


The Drawing-Room.

everything looks different fitted up amid the home surroundings of these flats from what it does on a showroom floor.

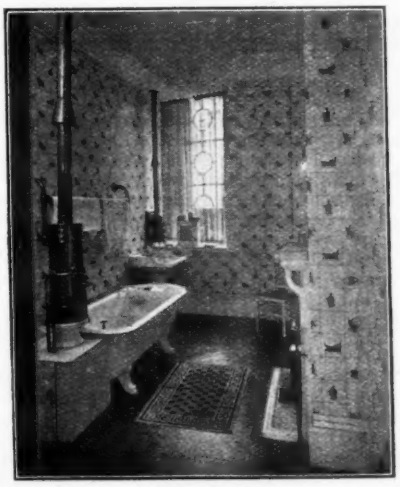
AT THE BON MARCHÉ, BRIXTON.

Necessarily, the arrangement of the various flats is on very similar lines; and to give the reader an idea of what these lines



The Nursery.

are, let us take the one that has been fitted up in an accessible part of the commodious Bon Marché, Brixton. The first room of the series is a Jacobean-style dining-room. The old-rose tiling which surrounds the gas-fire harmonizes perfectly with the oak fittings of the room. By the side of the fire is a little luxury in the form of a gas cigar lighter, which is also available for lighting

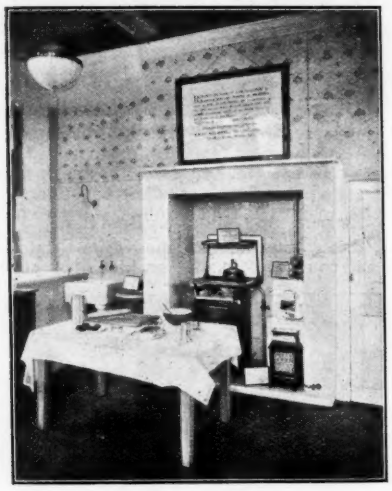


The Bathroom.

the fire. In this room, as well as in others, the fire is provided with a standard tap, which is about 2 ft. 6 in. above ground-level, thus permitting one to turn the gas supply to the fire on or off while standing, or even while sitting in the armchair near by. The head of the tap can be lifted off, to ease the minds of those parents who fear danger from their children playing about with it. The dining-room is lighted by four brackets, with old-rose shades, again in harmony with the scheme of decoration, and a two-light "Surprise" pendant over the table. The brackets are controlled by pneumatic switch (an unceasing joy to visitors), while the pendant is provided with an independent pilot-light, similar to the cigar and fire lighter.

Next is the bedroom, with a gas-stove having a boiling-ring on top. The Sheraton furniture is set-off by a two-light pendant over the dressing-table, and a bracket over the bed with the switch-control handy to anyone lying down.

The drawing-room is, of course, beautifully furnished; and here, as elsewhere, the colour scheme should please the most fastidious. The tiling round the fire is of French grey. The maximum of convenience is afforded here by the provision at the side of the fire of an afternoon tea boiling-ring. The lighting is by means of four switch controlled brackets, each with a pair of "candles,"



The Kitchen.

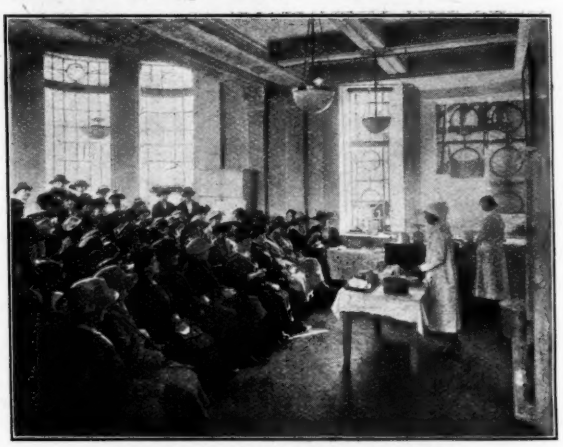
an incandescent gas standard lamp, and a bronze figure holding a "candle" gas light.

An old Dutch tile fireplace in the nursery contains a suitable gas-fire, and the picture-decorated furniture and walls are matched by a pendant with a shade illustrating a nursery rhyme in silhouette. There is also a "night-light" upright burner with an inverted shape mantle little larger than a big-sized pea, enclosed in an opal chimney, and giving a very soft, diffused light, which is just sufficient for the purpose required. The service of this gas night-light is something like 200 hours for a therm.

Fully worthy of the preceding rooms of the suite is the bath-room. Over the bath is a large geyser, and over the basin a smaller one; but both bath and hand basin can draw hot water from the circulator fixed in the kitchen, which also heats a large double towel rail on the wall by the side of the bath. Further to save labour, the whole of the metalwork in this room is bronzed, so that the light application of a leather or duster is all that would be required. Everything, of course, is fully connected up, and can be seen in action. A four-burner fire, with a small gas consumption, is enough to make the temperature comfortable. There are in the room two brackets with silica globes.

Finally, there is the combined kitchen and demonstration room. At the different flats, a gas-stove demonstration takes place daily, which is naturally one of the biggest features of the scheme. At these demonstrations various puddings, pastry, cakes, &c., are cooked by the Company's staff, though the primary object is not to give a cookery display, but to furnish information as to gas-stove management. While visiting the Bon Marché one afternoon last week, the writer found some fifty or sixty ladies seated in the demonstration room (frequently the attendance is even larger), and all obviously keenly interested in what was going on. At the close, too, a number of them proffered requests for special dishes to be prepared on specified future dates, thus showing their intention of coming again—and probably of bringing friends. That such great interest should be taken by the audiences in these demonstrations seems really strange, when one remembers that some 98 p.ct. of the consumers in the South Metropolitan Company's area already use gas-cookers.

This shows what a good plan it has been to enlarge this portion of the scheme to something far beyond the kitchen which would in the natural order of things be attached to such a flat. However, at one end of the demonstration room there is the kitchen, complete with gas-cooker, raised circulator, and gas-fire in the recess, and alongside a gas wash-boiler, a sink with hot water, and a gas-iron. The demonstration room is lighted by three semi-indirect fittings, controlled by switches.



Demonstrating the Use of the Gas-Cooker.

This, then, is a brief sketch of what has proved a highly successful system of familiarizing the public with the advantages of gas as a lighting and heating agent. Everything in the place is priced, and the assistants are in a position to take orders and put them through; while there is an abundance of literature in each room, to assist the staff in answering inquiries. One is very properly reminded that "Smoke, grime, and dust are unknown in the house where gas-fires are in use," and printed instructions can be found for reading the gas-meter regularly and checking waste. Very necessary steps, too, are taken to familiarize visitors with the nature of the therm. There are readable leaflets on the "Truth about Therms," "Therms and Cubic Feet—A Clear Answer," and "More about Therms." Tastefully framed little notices in each room explain what a therm of gas will do with the particular apparatus installed. Thus, the fires, according to size, may be on continuously for from $4\frac{1}{2}$ to 9 hours with a consumption of 1 therm, or one may have six hot baths from the geyser or circulator, or the use of the wash-boiler for three hours.

In the co-operative "Work-Made-Easy Flats," enterprise is receiving its due reward.

Steaming Inclined Retorts.

In view of the prevailing gas coal scarcity, Mr. A. F. Kersting has given, in the pages of the "Gas-Age Record," his experience in obtaining 10 p.ct. increased yield by steaming inclined retorts. At the Biloxi (Miss.) plant in 1918, with two benches of 15 ft. inclined retorts, experiments were made in passing blue water gas down through the retorts during the last $1\frac{1}{2}$ hours of the six-hour charge. Success was immediate, 22 p.ct. being assimilated without reducing the 580 B.Th.U. standard for mixed gas. When the growth of demand made it necessary to send out carburetted water gas, so that separate blue gas could not be made, superheated steam was tried on the inclined retorts. It was admitted through the old blue gas connections, and the yield was increased 10 p.ct. without reducing the B.Th.U. standard. The important feature in either steaming or blue gas mixing is to sweep this through the retort during the final coking stage—that is, the last quarter to one-third of the charging period of each retort in succession as the recharging cycles progress. At this time, the final coal gases from the core of the charge are being decomposed by over heating, due to diminished volume, before passing to the off-take. The blue gas or steam then prevents much decomposition, and conserves the light hydrocarbons. The steam passing over the surface of the coked charge forms some blue gas; and the protected final coal gas, being of higher quality, permits such a dilution that a yield of 10 p.ct. more gas is possible. In his case the sectional silica retorts were not noticeably affected by the use of the steam. Other advantages were that the retorts remained practically free of carbon; the standpipes remained clean; the tars were thinner, and special laboratory tests showed less carbon and naphthalene; there was less naphthalene in the gas; and while no tests were made for ammonia and cyanogen, doubtless the heat control of the final coal gas prevented some breakdown of the former into the latter, which adds much to rust troubles.

Institution of Mining Engineers.—The annual meeting of the Institution will be held at Burlington House, Piccadilly, on Thursday and Friday of this week, under the presidency of Sir John Cadman, K.C.M.G. Among the papers to be submitted are one by Prof. Henry Briggs, D.Sc., Ph.D., on "The Possibility of Spontaneous Combustion being Initiated by the Heat Produced in Crushing," and another by Dr. R. Lessing, on "The Disintegration of Coal by Acids."

LOW-TEMPERATURE CARBONIZATION AND THE ECONOMICS OF MANUFACTURE.

By GEORGE EVETTS, Assoc.M.Inst.C.E.

REFERRING to the article in the "JOURNAL" for Nov. 8, by Mr. Walter Chaney, the editorial in the same issue invites criticism of the figures in the article, and, presumably, of the principles involved.

Mr. Chaney, like any other reputable technical writer, invites investigation by gas engineers with a view to the correction of figures, if they should require it. Mr. Chaney, as the editorial states, has been astonished at the results; but he has evidently not scrutinized the figures closely enough before publication.

The writer, in his professional practice, is in daily contact with problems of the kind indicated in the article, and in considering the first column of the article (relating to Gas Undertaking "A") there appear to be so many inaccuracies that it is desirable to publish a criticism of the figures and comments on the principles involved. These remarks will be confined to the figures contained in the first column. The writer has not investigated the figures further; but it is possible that the same mistakes have been repeated.

Accepting the figures of savings for the moment, Mr. Chaney takes £2933 as the annual saving on the cost of gas *into the holder* for a 180 million works, and then proceeds to add the saving on costs of coal. But surely the saving on the cost of gas into the holder includes the saving on coal!

Mr. Chaney assumes that it is possible to make the same quality as declared; but probably a 500 B.Th.U. gas would have to be made in order to declare 490 with safety. However, no correction will be made in this article in regard to this discrepancy, as the adjustment would be common to all methods of carbonizing. Therefore, for all practical purposes the comparison will hold good. There is, however, another serious error in principle in the article referred to. In order to obtain the over-all cost of a mixed gas per therm, the percentage of the various gases is taken *by volume* and multiplied by the cost *per therm*, which is clearly incorrect. This is a mistake frequently made in other calculations far removed from the realms of gas; but the inaccuracy can be clearly explained by taking an extreme case.

Mix 1000 c.ft. of 1000 B.Th.U. gas at 1d. per therm with 1000 c.ft. of 100 B.Th.U. gas at 10d. per therm. There are two methods of obtaining the cost:

(*a*) By taking the proportional volumes and dealing with the cost per volume.
(*b*) By taking the proportional therms and dealing with the cost per therm.

(*a*)	1 vol. at 10d. per 1000 c.ft. . .	= 10d.
	1 vol. at 1d. per 1000 c.ft. . .	= 1d.
	2 vols. of mixed gas for . . .	20d.
	∴ 1 vol. of 550 B.Th.U. gas for. .	10d. = 1·82d. per therm.
(*b*)	10 therms at 1d. per therm . .	= 10d.
	1 therm at 10d. per therm . .	= 10d.
	11 therms for.	20d. = 1·82d. per therm.

The incorrect method is that adopted by Mr. Chaney—viz.:

(*c*)	50 p.ct. (by vol.) at 1d. per therm . .	= 0·5d.
	50 p.ct. (by vol.) at 10d. ,, . .	= 5·0d.
	100 p.ct.	at 5·5d. per therm.

In this extreme case the error is 3 to 1; but in the article referred to the difference is 0·5d. per therm, and the following table shows the effect of calculating the mixture on the two methods:

MR. CHANEY'S METHOD. *By Volume.*		CORRECT METHOD. *By Thermal Value.*	
Coal gas—	d.		d.
60 p.ct. at 8d. per therm	= 4·8	60 p.ct. at 8d. per therm	= 4·80
Blue water gas—			
23 p.ct. at 4d. ,,	= 0·9	14 p.ct. at 4d. ,,	= 0·56
Low-temperature gas—			
17 p.ct. at 9d. ,,	= 1·5	26 p.ct. at 9d. ,,	= 2·34
	7·2		7·7

In other words, if 23 p.ct. of *the volume* is taken it must be multiplied by the cost *per volume;* and if 4d. *per therm* is taken, it must be multiplied by the *percentage of therms.*

In this case, therefore, the annual saving on the cost of gas into holder is not 0·8d. per therm over-all, but 0·3d. per therm—viz., 8d. less 7·7d. Therefore, accepting for the moment the basis of the calculations, the two errors in principle to which attention has been directed result in a substantial whittling-down of the alleged savings.

The following statement contrasts the correct figures with the incorrect ones:

PER MR. CHANEY.	£	CORRECT FIGURES.	£
Saving in cost into gasholder .	2933	Three-eighths of £2933 .	1100
Saving in coals	1046	[already included] . .	—
	£3979		£1100

Little wonder that Mr. Chaney was astonished at the results!

In putting £1100 as the figure saved, the writer is showing the effect of the errors in principle in arriving at the conclusions; but the basis of the calculation needs some revision. It has been previously pointed out that the calculation of savings on tonnage of coal is unnecessary, since such savings are already included; but assuming that the savings are to be calculated in parts, and not as a whole, any calculation by taking differences in tonnage at the *gross* price per ton must be fallacious, since the question of residuals should be taken into account. Since the calculation in Mr. Chaney's case was redundant and incorrect, it need not be criticized in detail. But as some misguided reader may attempt an analysis on the lines indicated, some comment is necessary. The coal-saving basis, at the gross cost, is financially unsound. The writer has, during the past few months, come into contact with a small gas undertaking in such circumstances that it is preferable to use 2000 tons of coal per annum as compared with 1700 tons. According to Mr. Chaney's basis, this undertaking is 300 tons at £2 = £600 per annum out of pocket. As a matter of fact, there is a slight balance in favour of the larger amount of coal when selling the same quantity of gas.

The above remarks, however, are a mere digression (although of some importance). But it would be desirable to ask Mr. Chaney the following questions relating to the figures adopted as the basis of his calculations:

(1) Can he guarantee in any low-temperature plant 8000 c.ft. of 750 B.Th.U. gas = 60 therms? The writer cannot remember having seen such a high claim made before. Sir George Beilby has mentioned 3500 c.ft. of 1000 B.Th.U. gas; but Mr. Chaney's figure is a very different affair. It would appear that it is getting almost out of the region of low-temperature carbonizing; and the resultant fuel would be a bit low in volatiles.

(2) Where can blue water gas be produced at 4d. per therm into gasholder, with coke at 35s. per ton? Cost into gasholder is usually assumed to include the following: Coke, wages, salaries, purification, repairs to generator, vessels, blower, &c., and repairs to general works plant. Figures will be given later to show that this is on the low side.

(3) With coal at 40s. per ton, coke at 35s. per ton, and a production of 70 therms per ton of coal, is not 8d. per therm for coal gas too high, in the same works in which water gas is being produced for 4d.?

If in the same works coal gas costs 8d. per therm, and water gas only 4d., then the majority of the technical officials in the gas industry are fools in not making the minimum of coal gas and turning all their coke into water gas.

The following figures will give what the writer considers would be a fairer basis, taking the thermal production and costs of coal and coke at the same figures as Mr. Chaney. Although the production of 60 therms per ton is questioned, it should be admitted that 9d. per therm into holder seems a high price for this gas. It cannot be criticized, however, as the writer has no knowledge of the details on which Mr. Chaney has based his figures.

The following are reasonable figures, and are taken from actual results in works of the size named:

Coal Gas. Given by Mr. Chaney at 8d. per Therm.

			Per Therm. d.
180 million c.ft. at 490 B.Th.U.	= 880,000 therms.		
60 p.ct. coal gas.	= 528,000 ,,		
Coal used at 70 therms. .	= 7,543 tons.		
Coal cost. 7543 tons at £2	£15,086		
Less coke 3771 tons at 35s. £6599			
Tar 75,430 galls. at 4d. . 1257	7,856		
Net. . .	£7,230	=	3·29
Wages and salaries, hand-charged retorts [5·64d. per 1000 c.ft.]		=	1·15
Purifying at ½d. per 1000 c.ft.		=	0·10
Repairs to works. Retort plant 1d.			
General plant 1d.		=	2·00
Total			6·54

Sulphate is ignored, since it is of little value.

Water Gas. Given by Mr. Chaney at 4d. per Therm.

123,200 therms per annum = 41 million c.ft., or (say) 112,000 c.ft. per day.

			Per Therm. d.
Coke at 156 therms per ton			
790 tons at 35s.	= £1382	=	2·69
Wages and salaries. One man per shift at 10s.	= 3·22d.		
Salaries	= 0·50		
per 1000 c.ft. . . .	= 3·72	=	1·24
Purification at 0·30d. per 1000 c.ft. .		=	0·10
Repairs to works. 2d. per 1000 c.ft. for water-gas plant	= 0·67		
General plant as above .	= 1·00	=	1·67
			5·70d.

With regard to wages, it will be agreed that one man per shift for all duties cannot well be reduced. If the plant is worked spasmodically, then there would be nothing saved, and the 156 therms per ton of coke would certainly be subject to reduction.

It is obvious that, although the repairs to the water-gas plant are low, yet the gas must bear its portion of the repairs to exhausters, scrubbers, purifiers, gasholders, works mains, boilers, offices, &c. Strictly speaking, it should bear more than a mathematical proportion, since a therm of water gas (uncarburetted)

would certainly cause more wear and corrosion than a therm of coal gas.

Revision of Cost Table.—The following table shows the costs worked out on the correct lines, with the above figures. Two portions are given, one of which embodies low-temperature gas at 9d., and the other at 6d. per therm, into gasholder.

	Low-Temperature Gas at 9d.		Low-Temperature Gas at 6d.
60 p.ct. coal gas at 6'54d.	3'92	..	3'92
14 p.ct. water gas at 5'70d.	0'80	..	0'80
26 p.ct. low-temperature gas	2'34	..	1'56
	7'06	..	6'28

From the above, it will be seen that if low-temperature gas is 9d. per therm, money is lost by the admixture. If low-temperature gas is 6d. per therm, then there would be a slight saving, amounting to 0'26d. per therm. The costs would be equal if low-temperature gas cost 7d. per therm.

The limit in economic folly would be reached, however, if the unsuspecting gas manager should fall into the trap which is indicated at the bottom of the first column of Mr. Chaney's article (p. 367). The words are quoted here in full: "In this instance, the cost of low-temperature gas could have been increased to 14d. per therm before the original price of 8d. per therm was overtaken, the saving of coal remaining as above."

Now this can only mean one thing—namely, that undertaking "A" could purchase low-temperature gas at 14d. per therm without losing anything on the cost of gas into holder, but would still show a saving on quantity of coal, and presumably (although this is not stated) the corresponding cash saving of £1046.

The writer has already dealt with the fundamental error in taking the coal saving in addition to the over-all saving; and the "saving on coal" as a quantity only, without any financial advantage, is a delusion. The amazing thing is that the three lines reproduced did not give Mr. Chaney the clue that there was something wrong in his reasoning.

What would be the verdict on the action of a gas manager who, perhaps selling gas at 13d. a therm, bought it at 14d. a therm, or even manufactured it at 14d? For what purpose? To enable him to use an admixture of something which he can make at 4d. a therm, and retain the same calorific value, and putting on the market a competitive form of fuel.

The writer is well aware that Mr. Chaney in this statement was only intending to convey the limiting price at which the gas undertaking could afford to go in certain circumstances. In criticizing the statement, the real point at issue is that the undertaking would be asking for financial disaster in paying 14d., and would be most unwise to pay even 9d., and not well advised in paying 7d., which, by the previous table, brings the cost of mixed gas equal to coal gas.

It may be properly asked, why not pay 7d. per therm? The answer is, because there is a method at hand which produces gas for 4d. per therm (according to Mr. Chaney) or 5'7d. per therm according to the writer. Further, this suggestion, if carried out, would result in an admixture of two gases instead of three; and the auxiliary (blue water gas) is made from the principal bye-product already existing.

The calorific value question can be dealt with by an equally satisfactory method, and 490 B.Th.U. gas can be manufactured:

Make per ton = 70 therms (say, 11,667 c.ft. of 600 B.Th.U. gas).
63½ p.ct. by vol. × 600 = 114 millions = 684,000 therms
36½ " " × 300 = 66 " = 198,000 "
100 p.ct. by vol. × 490 = 180 millions = 882,000 therms
Coal Gas = 77'5 p.ct. of therms.
Water Gas = 22'5 " " "

The above figures of make and calorific value are not impossible; and the writer knows more than one works where the figures are closely in approximation. The cost of this admixture is given herewith, on the original costs and on the costs given in this article:

	On Original Basis.		On Revised Basis.
77'5 p.ct. coal gas at 8d. . . .	= 6'2d.	.. at 6'54d.	= 5'07d.
22'5 p.ct. water gas at 4d. . . .	= 0'9d.	.. at 5'71d.	= 1'28d.
Over-all, per therm .	7'1d.	.. Per therm	6'35d.

These figures compare with Mr. Chaney's figure of 7'2d. per therm on his incorrect reasoning, but 7'7d. on his separate costs correctly proportioned. In other words, by mixing with blue water gas only the cost is 7'1d. per therm, instead of 7'7d. per therm, accepting the costs per therm for the separate gas according to the original article. This amounts to a saving of £2200 per annum.

Accepting the writer's revised figures, the cost is 6'35d. per therm, instead of 7'06d. per therm when low-temperature gas is at 9d., and 6'28d. per therm when low-temperature gas is at 6d. Therefore, there is a slight apparent saving in cost when low-temperature gas can be bought for 6d. per therm. In practice, however, this would be covered by the saving in wages on blue water gas, as the volume of gas made is increased from 123,200 therms to 198,000 therms. Turning to the amount of coal and coke used, the following is the position.

$$\text{Coal for coal gas} = \frac{684{,}000}{70} = 9771 \text{ tons}$$

$$\text{Coke for water gas} = \frac{198{,}000}{156} = 1269 \text{ tons}$$

Therefore the tonnage of coal saved, as compared with Mr. Chaney's method is	11,357 − 9771 = 1586 tons
Additional coke handled is.	1,269 − 790 = 479 tons
Saving of cost on the balance is	1,586 × £2 = £3172
Less . . .	479 × 35s. = 839
	£2333

Therefore, if we adopt Mr. Chaney's fallacious reasoning, the method above outlined saves nothing on the cost into gasholder (with low-temperature gas at 6d. per therm), but shows a saving of £2333 on coals.

As before pointed out, the writer has not troubled to analyze the figures further; but if low-temperature carbonization cannot show anything better than this, then it will never make much progress. He is convinced, however, that there is something very much better in low-temperature carbonization than one would gather from the above analysis of the article. In the original article as published, the figures are open to serious criticism, the results are worked out on a wrong basis, and the conclusions arrived at are disastrous. The real position, however, is different; and low-temperature carbonization—not necessarily on the system adopted by Low Temperature Carbonisation, Ltd.—is worthy of the serious consideration of gas engineers as an adjunct to town gas manufacture.

Incidentally, the conclusions arrived at in criticizing the figures have suggested the method of carbonizing which in principle is adopted by more than one undertaking in the writer's knowledge—viz., to make a rich coal gas and put in it the maximum admixture of blue or very lightly carburetted water gas. The logical development of this method would appear to be the making of a still higher quality of coal gas—*e.g.*, by low-temperature methods. This may be the solution in certain conditions; but there are very many factors to be taken into consideration, of which cost into gasholder is only one. The economics of the therm are too complex to be dealt with in the course of an article; but if this contribution throws any light on the methods of calculating the value of an admixture, the writer is gratified at having been given the opportunity of getting it published.

DESIGN AND CONSTRUCTION OF A 12½-MILLION GASHOLDER.

By R. J. MILBOURNE, Assoc.M.Inst.C.E., F.C.S.

(*Concluded from p.* 363.)

ROLLERS AND CARRIAGES.

The system of tangential combined with radial rollers should always be adopted in large gasholders, as the effect of this combination considerably reduces the strain on the guide framing. With radial rollers only, the whole force of the wind pressure against a holder takes a bearing on about one-third of the number of standards.

In the present instance (according to Miller), out of the total number of 34 radial rollers, only 11, standing at an angle of less than 60 degrees with the direction of the wind, are effective. Therefore the combination of radial and tangential rollers distributes the force of the wind (in varying proportions) on 29 out of the total number of 34 standards, thus thoroughly supporting the holder, and thereby reducing to a minimum the strain in the guide-framing. This is shown in fig. 1 (see appendix), where five of the radial rollers are acting independently, and six are acting in conjunction with the tangential rollers.

All the roller carriages attached to the dips of three lifts and the margin row of the inner lift are provided each with two tangential rollers and one radial roller. The 34 top carriages of the inner lift are formed of two ⅜ in. plates, stiffened with 5 in. by 3 in. by ½ in. angles on the outside and 3 in. by 3 in. by ½ in. on the inside, securely cross-braced together. The foot is bolted to the margin row through 6 in. by 6 in. by ¾ in. angles by 1¼ in. bolts; the head being stiffened and attached to the crown by 5 in. by 5 in. by ⅜ in. angles acting as diagonal stays. The radial rollers are 2 ft. 3 in. in diameter by 4½ in. wide, and the tangential 10 in. diameter by 3½ in. wide.

The dip carriages of the second and third lifts are likewise each made of two ⅜ in. plates, stiffened by 5 in. by 3 in. by ½ in. and 3 in. by 3 in. by ½ in. angles, the foot being bolted to pressed-steel brackets attached to the dip, and the head stayed to the dip by means of 3½ in. by 3½ in. by ½ in. and 3 in. by 3 in. by ½ in. diagonal angle-stays. The radial rollers are 1 ft. 8 in. and 1 ft. 3 in. in diameter respectively by 4½ in. wide, and the tangential 10 in. in diameter by 3½ in. wide in each case.

Each outer lift dip carriage is composed of four 8 in. by 3½ in.

by 3½ in. by 22·72 lb. channels, each pair bolted through distance-pieces back to back, the channels being bolted to pressed-steel brackets attached to the dip. Both tangential and radial rollers are provided with suitable adjustment. All the tangential rollers of the top carriages and dip rollers are brass-bushed, the rollers being of cast iron. There are thirty-four dip or top carriages to each lift.

The cup carriages of the inner, second, and third lifts are of ⅝ in. flanged steel plates, pressed to fit the cup, and secured to it and also to prolongations of the vertical stays. There are 68 to each lift. The rollers, which are 1 ft. 2 in. in diameter by 3½ in. wide, are of cast iron and are adjustable, and have steel axles 1½ in. in diameter. The 68 roller carriages on the bottom curb of the outer lift are of ⅝ in. flanged steel plate, and are fixed between the two rings of sections forming this composite curb. The rollers and axles are of the same dimensions as those in similar positions on the other lifts. To the outer lift there are also provided 68 intermediate carriages arranged about half-way up the lift. These are of ⅜-in. plate bossed-up at the axles, are stiffened with angles, and are bolted to the two 4 in. by 2½ in. by ⅜ in. channels forming the external vertical stays of the outer lift. The rollers are 1 ft. 2 in. in diameter by 3½ in. wide, and are capable of being adjusted.

Ladders and Landing Platform.

There are six flights of ladders about 32 ft. to 35 ft. long, and five landing platforms. The ladder sides are of 2½ in. by 2½ in. by ⅜ in. angles, and are 1 ft. 2¾ in. in width. The rungs are made of ¾ in. steel rounds. The head of each ladder leads on to a landing platform of ¼ in. chequered plating, resting on, and secured to, the horizontal girders. The platform is railed round with two lines of 1 in. diameter hand railing. The feet of all but the first flight of ladders rest on landings below them. The inner side of each ladder is stayed to the nearest standard in two places by 2½ in. by 2½ in. by ⅜ in. angles. On the crown of the holder a landing platform is fixed to the margin row. The side and middle plates are of $\frac{5}{16}$ in. steel plate stiffened by means of 3½ in. by 3½ in. by ⅜ in. angles, to which the 7 in. by 3 in. platform boards are bolted. The landing platform is 9 ft. 4 in. wide, having an overhang over the top curb of the inner lift of 4 ft. 5 in. The crown can, therefore, be boarded conveniently from the ladders at any position of the holder. Hand-railing is provided at the sides for ease in boarding at the middle or any intermediate position. The crown hand-railing consists of three tiers of 1 in. internal diameter piping, and is arranged round the edge of the inner lift, except where the landing platform is placed. It is attached to the top carriage, and is intermediately supported by steel standards.

Interesting Figures and Facts.

It may be of interest to record the following facts. The weight of the floating bell was 1877 tons, and the weight of the guide-framing and tank ironwork 1783 tons; therefore the total weight equals 3660 tons.

The theoretical pressures given by the holder are:

When the inner lift only is inflated	5'6 in. of water.
When the inner and second lifts are inflated . .	7'8 ,,
When the inner, second, and third lifts are inflated	9'8 ,,
When all four lifts are up	11'6 ,,

The crown sheets, side sheets, cups, and dips would cover an area of nearly 5·7 acres. The crown of the holder stands 202 ft. above water level in the tank when fully inflated.

All parts of the floating holder and guide standards, girders, ties, &c., were made to exact calculated lengths, with the result that everything fitted together perfectly in the erection without the slightest alteration and without any "packing." The whole of the radial crown sheeting comprising the seventeen rows also came together perfectly when assembled in position at Sydney, without the slightest buckle or inaccuracy of alignment of any of the joints.

The holder and guide-framing is constructed of best Siemens-Martin mild steel capable of bearing a tensile strain of not less 28 tons and not exceeding 32 tons per sq. in., with an elongation of 20 p.ct. in a length of 8 in.

The whole of the work received one coat of Donald Macpherson & Co.'s red-oxide paint before dispatch. The paint necessary for coating the holder and framing after erection was provided by the Gas Company; and the work was carried out by Colonial journeymen painters.

In conclusion, the writer wishes to record his appreciation of the valuable assistance rendered to him by Mr. F. S. Cripps, Assoc.M.Inst.C.E., in checking over the calculations of strains in the complete structure, and for many suggestions carried into effect during the preparation of the working drawings, all of which were submitted to him for his criticism. The various points which arose during the preparation of the drawings were fully dealt with by him.

APPENDIX.

PRESSURE VALUES OF ROLLERS.

The pressure values of the rollers are as shown below in fig. 1.

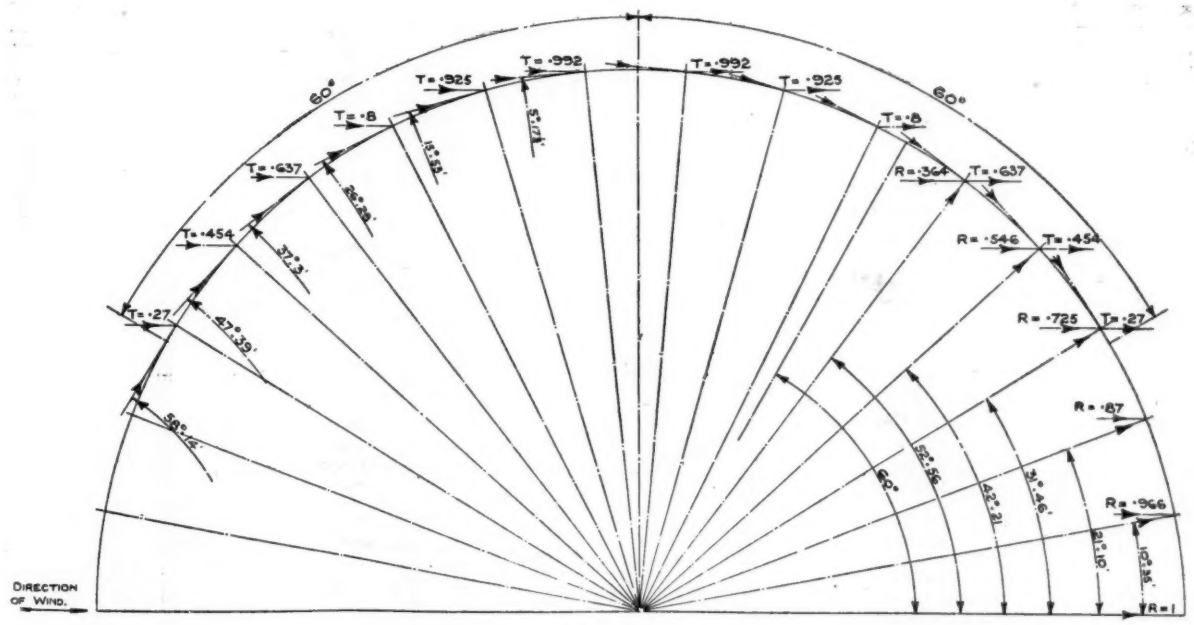


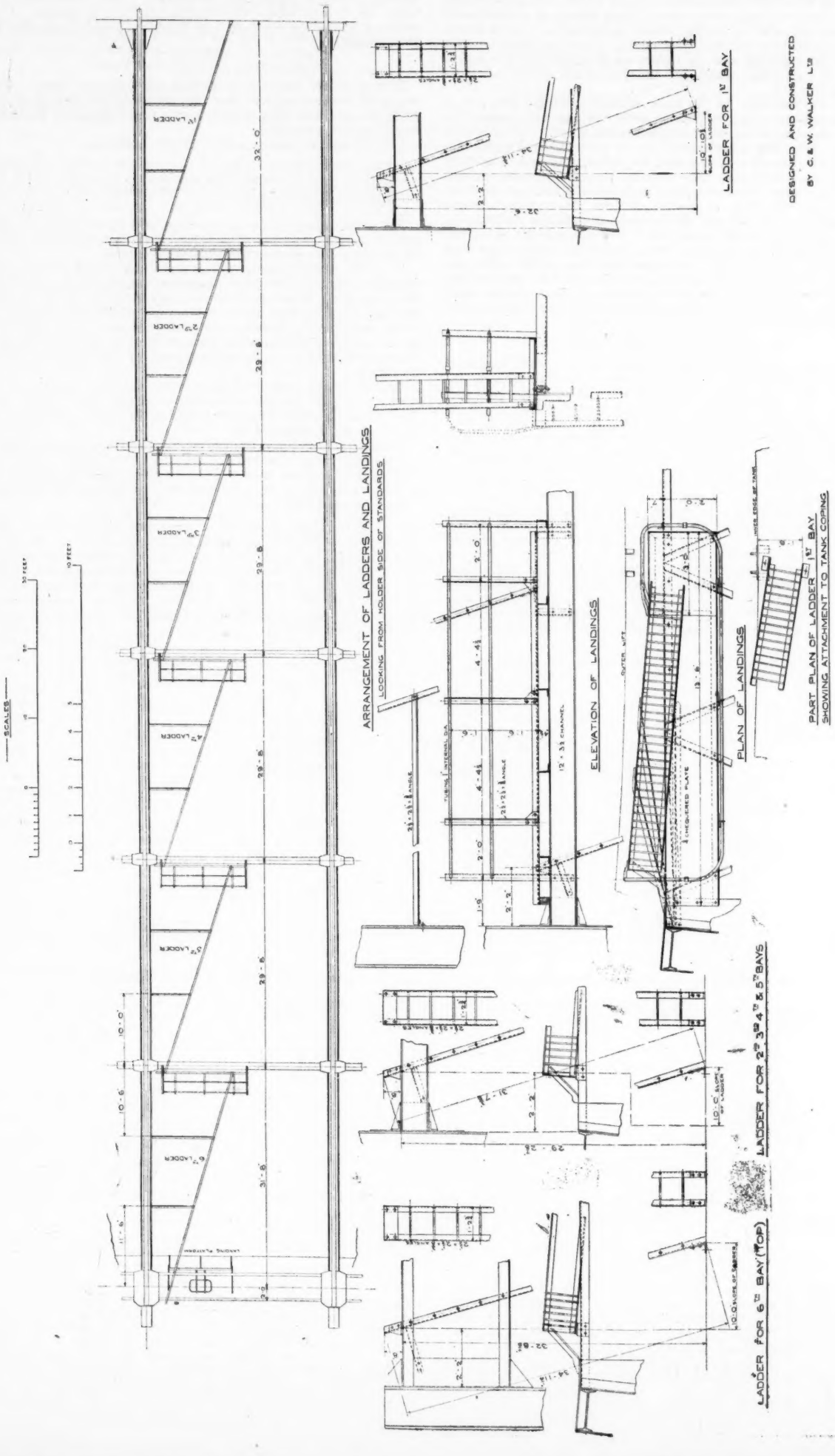
FIG. 1.

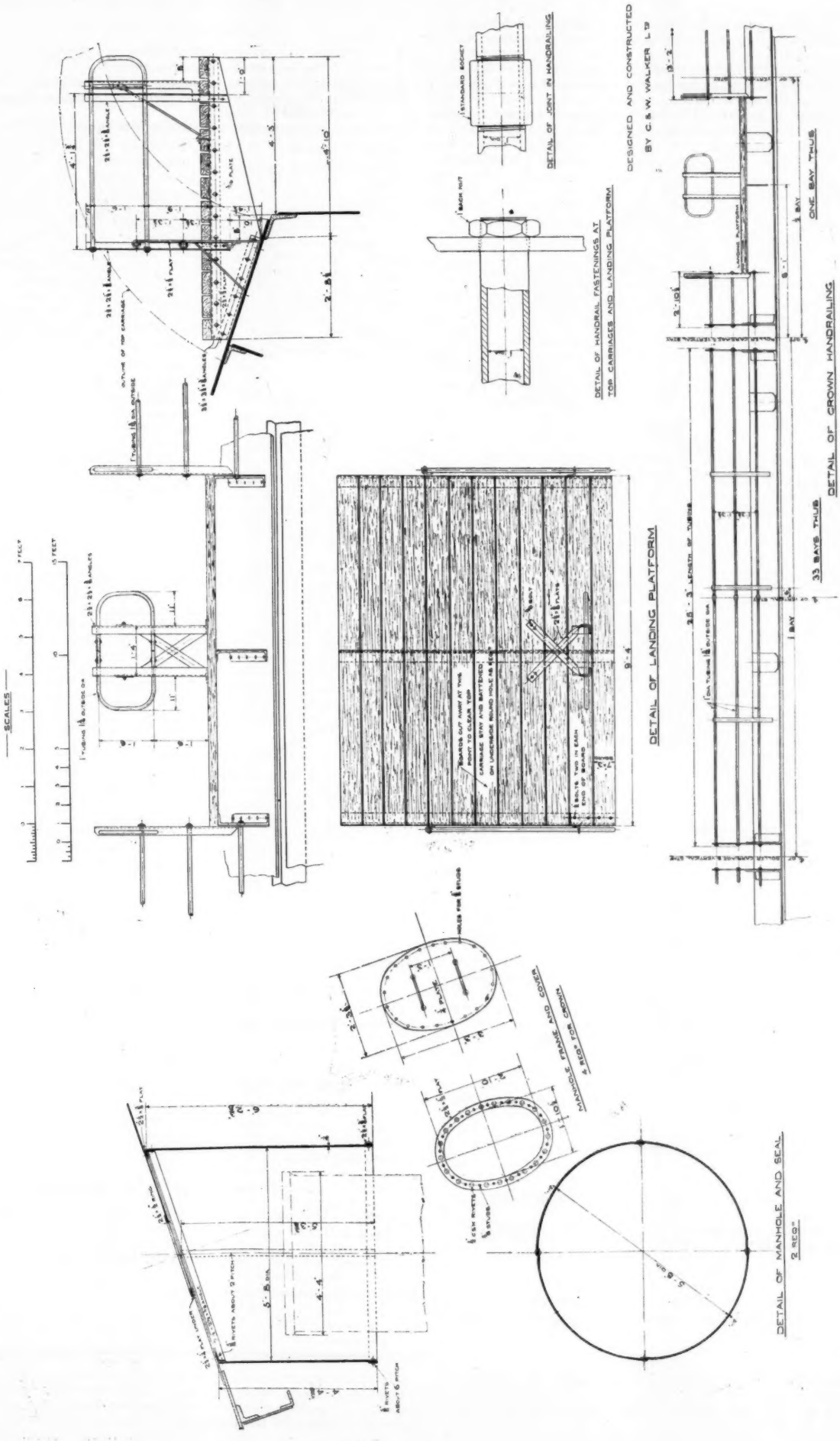
Radial.

1 cos² 0°	= 1·000
2 cos² 10° 35′ = 2 (·966)	= 1·932
2 cos² 21° 10′ = 2 (·870)	= 1·740
2 cos² 31° 46′ = 2 (·725)	= 1·450
2 cos² 42° 21′ = 2 (·546)	= 1·092
2 cos² 52° 56′ = 2 (·364)	= ·728

Tangential.

4 cos² 5° 17½′ = 4 (·992)	= 3·968
4 cos² 15° 53′ = 4 (·925)	= 3·700
4 cos² 26° 28′ = 4 (·800)	= 3 200
4 cos² 37° 3′ = 4 (·637)	= 2·548
4 cos² 47° 39′ = 4 (·454)	= 1·816
4 cos² 58° 14′ = 4 (·270)	= 1·080
Total . . .	24·254


GASHOLDER—12½ MILLION CUBIC FEET CAPACITY.
DESIGNED AND CONSTRUCTED BY C. & W. WALKER LTD
ARRANGEMENT OF LADDERS AND LANDINGS
LOOKING FROM HOLDER SIDE OF STANDARDS
ELEVATION OF LANDINGS
PLAN OF LANDINGS
PART PLAN OF LADDER 1ST BAY SHOWING ATTACHMENT TO TANK COPPING
LADDER FOR 1ST BAY
LADDER FOR 2ND 3RD 4TH & 5TH BAYS
LADDER FOR 6TH BAY (TOP)
SCALES
1ST LADDER
2ND LADDER
3RD LADDER
4TH LADDER
5TH LADDER
6TH LADDER
32'-0"
29'-8"
29'-6"
31'-6"
10'-0"
10'-6"


DESIGNED AND CONSTRUCTED BY G. & W. WALKER LTD
DETAIL OF JOINT IN HANDRAILING
DETAIL OF HANDRAIL FASTENINGS AT TOP CARRIAGES AND LANDING PLATFORM
DETAIL OF LANDING PLATFORM
DETAIL OF CROWN HANDRAILING
ONE BAY THUS
33 BAYS THUS
1 BAY
SCALES
DETAIL OF MANHOLE AND SEAL
2 REQ.D

GASHOLDER—12½ MILLION CUBIC FEET CAPACITY.

GRAPHICAL DETERMINATION OF TOP CURB INERTIA.

Fig. 2 represents the method adopted to determine the inertia of the gasholder top curb about the minor momental axis X—X.

First construct the funicular polygon α, so that the axis X_1—X_1 is approximately parallel to the margin and second row of crown-plates forming the portion of the top curb.

Then construct the second funicular polygon β, which will give the axis Y_1—Y_1 at right angles to axis X_1—X_1.

When

$Ix = 6177$.

A = Sectional area of top curb in inches = 158·375.

P = Crippling load in tons per square inch.

C = Total compressive stress on top curb = 700 tons.

l = Distance between top roller carriages in inches = 340.

r = Least radius of gyration.

c = Actual compressive stress in tons per square inch of curb.

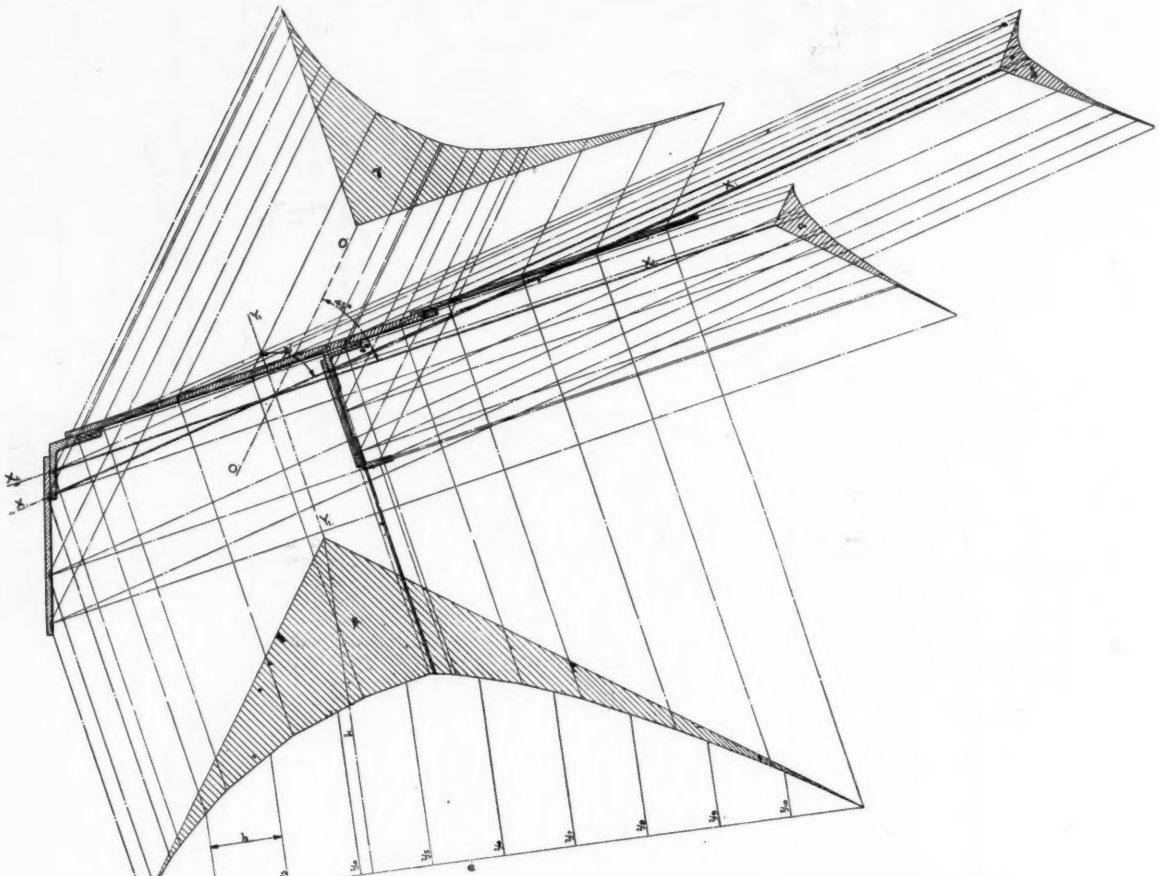


FIG. 2.

A third funicular polygon γ must now be constructed which will make the axis O—O equal to an angle of 45° with axis X_1—X_1.

The areas of the funicular polygons may be found by Simpson's First Rule thus—

$$A_1 = \frac{ke}{2} - \frac{h}{3}\left\{4(y_2 + y_4 + y_6 + \ldots) + 2(y_3 + y_5 + y_7 + \ldots)\right\}$$

When, as shown for the funicular polygon β in fig. 2,

A_1 = Area of funicular polygon in square inches.

k = Height of perpendicular of triangle in inches.

e = Length of base in inches.

h = Distance between ordinates

$y_2, y_3 \ldots$ &c. = lengths of ordinates in inches.

To find the correct angle between the axis Y_1—Y_1 and the minor momental axis X—X

Then

$$Tan\ 2\psi = \frac{2\gamma - (\alpha + \beta)}{\beta - \alpha},$$

where

ψ = angle which axis Y_1—Y_1 makes with minor momental axis X—X.

The minimum moment of inertia (Ix) may be found mathematically by the following equation:

$$Ix = \frac{A}{2}\left\{\alpha + \beta - (\alpha - \beta)\ sec\ 2\ \psi\right\}$$

where A = sectional area of top curb in square inches; or

Ix may be arrived at graphically by constructing the funicular polygon δ.

Then

$$Ix = A\delta = 6177.$$

From the value of Ix thus found, the least radius of gyration, the compressive stress per square inch of section, and the factor of safety in the top curb can be ascertained in the following manner.

Then

$$r = \sqrt{\frac{Ix}{A}} \text{ or } \sqrt{\delta}$$

Substituting values,

$$r = \sqrt{\frac{6177}{158{\cdot}375}} \text{ or } \sqrt{39} = 6{\cdot}245.$$

Therefore the ratio of slenderness

$$\frac{l}{r} = \frac{340}{6{\cdot}245} = 54{\cdot}45$$

For steel struts with fixed ends (Gordon's Formula),

$$P = \frac{24}{1 + \frac{1}{25{,}000}\left(\frac{l}{r}\right)^2}$$

Substituting values

$$\frac{24}{1 + \frac{1}{25{,}000}\left(54{\cdot}45\right)^2} = 21{\cdot}45 \text{ tons per sq. in. crippling load.}$$

(1) Then

$$c = \frac{C}{A} = \frac{700}{158{\cdot}375} = 4{\cdot}42 \text{ tons per sq. in.}$$

(2) Therefore factor of safety

$$= \frac{P}{c} = \frac{21{\cdot}45}{4{\cdot}42} = 4{\cdot}85$$

The death occurred recently, in his 81st year, of Mr. Thomas E. Shadbolt, formerly Manager to the Grays and Tilbury Gas Company. He retired some twelve years ago, after a quarter-of-a-century's service with the Company.

GAS MANUFACTURE IN SOUTH WALES.

ITS PAST——AND PROSPECTS.

By Mr. J. MOGFORD, of Briton Ferry.

[A Paper presented at last month's meeting of the Wales and Monmouthshire District Institution of Gas Engineers.]

The freedom given to gas undertakers by clauses 1 and 10 of the Gas Regulation Act will probably lead to modifications of the present methods of manufacture and supply. Large undertakings, whose policy has to be framed with a view to the future demands of a decade or more, are unlikely to make revolutionary changes; but administrators of smaller concerns might be tempted to adopt new and untried methods of manufacture.

When entering on a new era, it is wise to take a retrospect of the past, as it enables one to see in clearer perspective and to appreciate the future lines of development in process and practice. It is for this reason that I venture to lay before you some notes on the history of gas manufacture in this district, culled from old volumes and the records of a Neath engineering works. The foundation of the gas industry was laid by Murdoch; but the land was cleared by chemists and philosophers who preceded him.

EARLY CHEMISTS.

The latter part of the seventeenth and the whole of the eighteenth century was a period of rapid development in the science of chemistry. The work of the old alchemists was being tabulated and scientifically arranged by leading philosophers. Elementary substances, as we know them, were being isolated in rapid succession, and every endeavour was made to prove the existence of what Becher had called phlogiston, which was regarded as "the matter of heat" or "the food of fire." Their researches led to the distillation of all kinds of substances, among others wood and coal. The appliances used by them in distillation were crude; but essentially they were the same as are employed to-day in gas manufacture.

Dr. Hales, Priestley, Cavendish, and Lavoisier used retorts of glass, earthenware, and iron. The hydraulic seal and bubbling washer were known to them; the former being used to isolate gases, and the latter to absorb ammonia in water and to remove acid gases by fixed alkali. Priestley used a gun barrel as a retort, stopping up the touch-hole; and Lavoisier invented the floating bell gasholder. The inflammable gas we know as water gas was produced during their researches by passing steam over charcoal in a red-hot tube. The history of the production of inflammable gas from coal by Dr. Hales and Dr. Clayton is familiar to most; but the historic essay on pit coal by Dr. Richard Watson has hardly been given the attention it merits.

DR. WATSON, BISHOP OF LLANDAFF.

Dr. Watson was Professor of Chemistry and Professor of Divinity at Cambridge, and later Bishop of Llandaff. Churchmen in the diocese of Llandaff remember him hardly with reverence, for we are told that: "He was appointed Bishop of Llandaff, in South Wales, and went to live for 34 years at his delightful seat of Calgarth Park in Westmoreland, with occasional visitations of his diocese which were as short as they were few." Gas engineers in the diocese can well pardon his episcopal delinquencies, and need hardly regret that the district provided him with funds that gave him leisure to write an essay, which, for the period in which it was written (1781), cannot be considered other than remarkable. Among other matters it deals with are: "Analyses of Coals made by Chemists, in 1775." "The Variation in Liquid Distillates from Coal according as the Heat used in Conducting the Distillation has been less or greater." "The Difference in the Quantity of Liquids produced from Different Coals." "Organized Research Work for the Advancement of Knowledge, and in particular Research on High and Low Temperature Distillation." He records that "coak was an article of trade before his experiments on coal were made." Coke was used for the extraction of iron; but charcoal iron was of better quality, being more malleable. Tar was made by Becher in the time of King Charles II. In 1781, it was made at Bristol, and Breseley in Shropshire. At Liège, coal was distilled in a kind of still consisting of two large cast-iron pots. In England, it was carbonized in ovens; the tar being recovered and dehydrated. Dr. Watson suggests the bye-product coke-oven, discusses the exhaustion of the coal measures, and concludes with a strong paragraph on the pollution of the atmosphere by the consumption of coal.

It is nearly a century and a half since the essay was written; but many of the points are being discussed to-day as it they were new. On his infrequent visits to the diocese, Dr. Watson was sometimes the guest of the old ironmasters; and it is possible that the subject of the essay was conceived during an inspection of an early coking plant in the district. Many of us would agree with him on the superiority of charcoal iron; and would, if it were available, prefer it to modern steel for gasholder construction. The latter part of the eighteenth century has been described as "one of the most fruitful in the science of chemistry."

PRIESTLY AND MURDOCH.

Priestly, Cavendish, Dalton, Henry, and Davy were engaged on research work, and discovery followed discovery in rapid succession. Birmingham at this time seemed to be a centre of scientific research, and philosophic societies met monthly to discuss scientific problems. A leading spirit of the time was Matthew Boulton, F.R.S., of Soho Foundry. A visitor to these works about the year 1800 is enthusiastic regarding the products of the factory, and the engines and machines by which they were manufactured, and writes as follows: "The superiority of these works may be attributed in part to the establishment of a seminary of artists for modelling and drawing. Men of genius, attracted by the fine taste and liberality of Mr. Boulton, were drawn together, and their united efforts have produced extraordinary effects." It is evident that when young Murdoch wandered into the Soho Works, and entered this seminary of men of genius, he found an atmosphere and company congenial to one of his temperament; and here his attention was drawn to the experiments on distillation which were being made by the philosophers of the day.

Samuel Smiles, in his "Lives of Engineers"—Boulton and Watt—tells us that Priestley was an intimate friend of Boulton, and that the funds for his experiments were provided by Darwin, Wedgewood, Boulton, and Watt. Boulton himself dabbled in chemistry, and turned Murdoch's bedroom into a laboratory. Murdoch, in "Philosophical Transactions," 1808, says "he was unacquainted with the circumstance of the gas from coal having been observed by others to be capable of combustion." Whether he was acquainted with its previous production or not, it is clear that the idea of using coal gas for illuminating purposes was born of Murdoch at Redruth. Smiles also implies that the genius displayed by Murdoch in perfecting the steam-engine outshone even that of Watt. Gas lighting was introduced into South Wales direct from Cornwall. Murdoch endeavoured to interest the Welsh mine owners in the new light.

INTRODUCTION OF GAS LIGHTING TO SOUTH WALES.

The copper ore raised in the Cornish mines was smelted at Swansea and Neath, and there were intimate business relations between the districts. There settled in South Wales a colony of Cornishmen, among them being engineers who erected works at Neath Abbey. Some of the earliest steam-engines were made at these works, and supplied to the Cornish copper mines. The drawings of these engines, and their accompanying cast-iron boilers, are still available for inspection. The engine makers were in touch with Murdoch and his contemporary Trevethic, as they manufactured high-pressure steam-engines, and soon became makers of gas plant, erecting gas-works in Somerset, Cornwall, Ireland, and throughout South Wales.

The first works were erected in 1820 at Neath Abbey, and the Hafod Rolling Mill, Swansea. The plant consisted of two cast-iron cylindrical retorts, hydraulic main, wet lime purifier, and gasholder; the whole being erected in the open, at the end of the buildings to be supplied with gas. Brecon was lit about 1820. Swansea was first lighted by gas on March 1, 1821, under the direction of a Dr. Wilkinson. Cardiff gas supply commenced on Oct. 25, 1821; Carmarthen in 1822; and Newport on Nov. 11, 1825.

In the early days cast-iron retorts of various sections were used, and also kidney-shaped retorts made of riveted wrought iron. These retorts sometimes had shelves in them. Later, brick retorts were tried; and in one or two instances chamber ovens, similar to coke-ovens, were used. Water-cooled condensers and dry lime purifiers were introduced in 1822, and in 1833; a bubbler-washer was made for the extraction of ammonia. Some years ago I drew your attention to a drawing (signed, and dated 1839) of a cast-iron vertical retort. With the adoption of higher heats, clay retorts, and the use of larger apparatus, the Neath Abbey Iron Company ceased to manufacture gas plant, and reverted to their business of building engines and mill machinery.

You are familiar with the later improvements in gas manufacture, the introduction of gaseous firing, purification by oxide of iron, rotary and centrifugal scrubbers, telescopic holders, &c.; but it might be worth while drawing attention to processes that have been tried and abandoned, or used only in isolated cases. In the earliest days an attempt was made to supplant coal gas by gas produced from whale and other oils; but after a few years, the manufacture was abandoned, and coal gas substituted. The oil-gas apparatus used by John Taylor is illustrated in "Lectures on Select Subjects," by James Ferguson, F.R.S., published in 1823. Clegg patented a process for the direct recovery of ammonia. Phosphate of magnesia has been used for the extraction of ammonia. This can be revivified and re-used. Barlow pointed out the benefits to be derived by "sweeping a newly-charged retort with water gas, hydrogen, or other low-grade gas." It gave an increased yield, and prevented the decomposition of the hydrocarbons. He also mentioned the disadvantages of over-steaming. A Dinsmore process of enrichment by tar was tried in many works. A process for the reduction of sulphur compounds by passing the gas through heated tubes was patented in 1818.

The idea of carbonization at the pit head is not a new one. Samuel Baldwin Rogers, of Newport (Mon.), spent considerable energy and money advocating a bulk supply to London from Wales almost a hundred years ago.

INDUSTRIAL GAS.

Gases other than town gas have from the beginning held a conspicuous place in the metallurgical processes of South Wales. During the first half of last century, blast-furnace gases were allowed to burn at the top of the furnaces; the flame being visible for miles. At the present time part of this gas is used for heating the blast, and the remainder burned under boilers. Coke-oven

gas was either allowed to waste or was consumed under boilers. To-day there are a few instances where it is distributed for domestic purposes; but most of it is used under boilers—a method little better than a convenient way of getting rid of it. Producer gas for industrial purposes came into general use in the district from the advent of Siemens to Landore, in 1868. The use of the Siemens open-hearth steel furnace became general in a few years; and the quantity of bituminous coal now gasified in producers for the manufacture of steel is considerably more than that used for town gas purposes. Suction gas, used in internal combustion engines for power purposes, has made great strides in the district during recent years.

The field opened by the Gas Regulation Act to the gas engineer in this and other industrial areas is very wide; and when he is ready and able to enter it, the manufacture of gas will acquire proportions little dreamt of by the gas engineer of last century.

Competition.

Suction gas competition is usually governable by the price charged for town gas, and users are generally ready and willing to adopt town gas when it is offered at a price that will bring running costs within reasonable distance of those entailed in manufacturing the lower-grade gas. The supply of producer gas for steel manufacture and the many other purposes for which it is at present made in individual plants, is one that offers great possibilities, but requires grave consideration. Experience in such supply is confined to the Mond Gas Company; but there is little doubt that present methods of working producers leave a margin for saving in bituminous coals and prospects that a supply of gas from a central station would be profitable where metallurgical processes are confined to concentrated industrial areas.

The chief competitors with gas supply at the present day are electricity and oil, both semi-nationalized. Few would credit the quantity of petroleum that is used in South Wales for lighting and other household purposes. High-priced gas has driven the poorer consumers to use oil for lighting; and, for the same reason, the sale of oil-cooking stoves has made considerable headway during the past three years.

Low-Temperature Carbonization.

Dealing with oil supply, I would divert your attention to the proposals for low-temperature carbonization, which are being thrust upon us daily. The advantages claimed by the advocates of this process are: (1) The necessity of producing oils in this country; (2) the provision of smokeless fuel. Many of you have seen the national oil refineries at Neath, and will readily agree that the engineer would be more than an optimist who would advise his directorate to adopt low-temperature carbonization in order that his works might compete with a nationalized concern in the sale of oil in times of peace, and act as a stand-by to it in times of national stress.

The gas industry has proved its patriotism, and paid for it; and we in South Wales would be well advised to leave oil supply to the refiners and the Government. Gas engineers of the last century had years of experience in low-temperature carbonization, and hastened to abandon it. The engineer of to-day knows that when his heats are low, his yields and profits are low. Experienced retort-house hands know that when heats are high things are going well, and their chief concern is that the fusion point of refractory material is too low to permit their doing better. The production of solid smokeless fuel has been part of our business since gas making began; and grates can be made suitable for its consumption.

Smokeless patent fuel manufacture has been an important industry in South Wales for many decades; tens of thousands of tons of it being turned out annually for home consumption and export. The fuel is made from anthracite duff, with a small percentage of bituminous coal and pitch binder. When this is not available, there is sufficient smokeless coal in the Welsh hills to serve many generations yet.

Electricity Supply.

The principal competitor, the electricity industry, has recently been taken under the wing of the Government, and this competition will, so far as the smaller gas undertakings are concerned, probably be serious in the near future. Under the Electricity Supply Acts the generation and supply of electricity is controlled by Electricity Commissioners sitting in London. The country is divided into districts, and each has a District Committee, who deal with all proposed extensions of generating or distributing plant, and make recommendations to the Commissioners. In this manner electricity supply is being co-ordinated on definite lines. Linking-up existing supplies is being dealt with, and the closing-down of the less remunerative stations considered. This linking-up of generating stations and the electrification of railways will carry an electric supply into every small village and town. High-tension mains will be run through industrial areas such as ours, and tapped for the supply of any district that desires current.

The financial clauses of the Act give local authorities permission to provide capital to meet the proposals of the Commissioners; and in our case the local Electrical Power Company has obtained similar powers. These can be used in such a manner that, indirectly, they would bring pressure on local authorities. Where there is no supply of electricity, the power company or others may apply for an Order to supply. This would induce the local authority to make application for an Order, so that they might retain the power for themselves. The Order being granted, the authority would have to lay distributing mains and provide such capital as would enable the power company to cover the cost of generating plant and high tension mains required for the demand in their district.

The proposals of the Electricity Commissioners include generation by the utilization of waste heat and surplus gases. Generation from the exhaust steam of large high-pressure engines, or from whatever blast-furnace or other very low-grade gases that are available, would tend to fuel economy; but in our district the surplus gas from bye-product coke-ovens would be of greater utility if distributed in gaseous form.

Present Methods of Gas Manufacture.

The present methods of gas production in this district are various, and include horizontal retorts, with and without auxiliary water-gas plant; inclined retorts; verticals, with steaming; and complete gasification plants. In some cases straight coal gas is diluted with producer gas made from coke in a simple suction-gas producer; and others distribute coke-oven gas. It would be well if we had a free, frank discussion such as would bring out the advantages and disadvantages of each system. Ventilation of the experiences of individual members would be of considerable value to those who have to decide the best method and type of plant to meet the future requirements of the district. Whatever the nature of the plant adopted, we must be careful that its principle is scientifically sound.

Research Work.

We have recently had instances of engineers attempting to hold up to derision the work of our professors; but it cannot be denied that in the history of gas production the honours go easily to the pure scientist. Our plant and methods are plainly developments of the apparatus used by Priestley, Hales, Clayton, Boulton, Watt, Cavendish, Watson, and Lavoisier. Accum was a chemist of no mean order; and to him and these products of the "seminary of men of genius"—Murdoch, Clegg, Southern, and Creighton—we are indebted for the sound foundation on which our industry is built. Gas manufacture in many a village to-day is almost identical with the practice of Clegg one hundred years ago.

In my remarks on low-temperature carbonization, I do not presume to criticize the valuable work done at the Fuel Research Station. My desire is to draw attention to the fact that the circumstances in our district are such as would make such a process ruinous to any undertaking adopting it. Research work on high-temperature carbonization would probably yield results that would give the engineer scope for his ingenuity. Internal heating might, if it could be done economically, relieve us of our present restricted carbonizing heats due to the fusion point of refractories. The quantity of heat necessary for carbonization is not great; and, with cheaper oxygen, the proposals of Prof. Cobb would command the attention of the practical engineer. Oxygen is at present distributed in strong metallic cylinders, just as was oil gas in the early days. Users of oxygen find that the cost of such distribution is heavy; and numerous small plants ars being installed in industrial areas. The power required for the separation of oxygen can be produced cheaply in the internal combustion engine; and we may yet see the requirements of a district in oxygen gas provided by the gas undertaking, and oxygen used for coal-gas manufacture.

Future Supply.

The supply of low-grade industrial gas is worth consideration, if we can be satisfied that such a proposal is commercially sound. Huge quantities are used in limited areas which would present few difficulties as to distribution. Whether suitable burners can be made to utilize this low-grade gas for lighting purposes, remains to be proved; but those who are accustomed to the blinding temperature of the steel furnace can have little doubt that producer gas would heat a room or cook a mutton chop.

Several of the members have experience in the distribution of coke-oven gas; and I suggest that the first work of those interested in fuel conservation should be the collection and distribution of the large quantities of such gas now wasted in this district. Future competition in the supply of light, heat, and power will be keener than hitherto. To meet such competition, gas will need to be distributed on other than the parochial lines of present practice—it must be of such quality as will best suit the requirements of the district, constant in calorific value, and cheap.

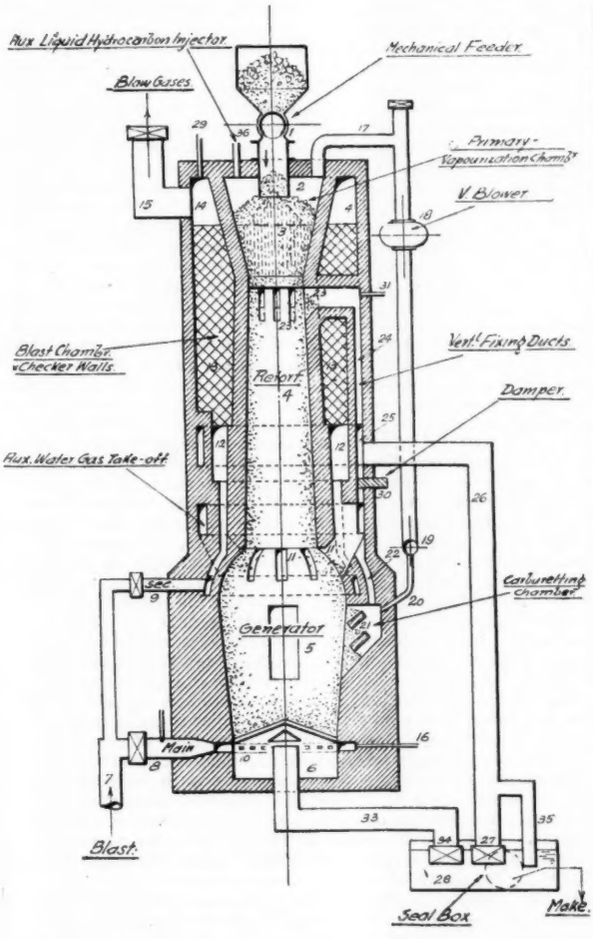
Cornish Association and the Education Scheme.—There was a meeting of the Cornish Association of Gas Managers at Truro last Thursday, to discuss the education and certification scheme. Mr. Walter Hole, who attended on behalf of the Institution of Gas Engineers, clearly explained the scheme, and satisfactorily answered all questions. The following resolution was unanimously passed, and the Hon. Sec. (Mr. F. G. Kingwell, of Falmouth) was instructed to forward it to the Institution of Gas Engineers: "That this Association, having carefully considered the scheme for the technical instruction and examination of those engaged in the gas industry, promoted by the Institution of Gas Engineers, and having heard Mr. Walter Hole's explanation of the same, heartily approves of the scheme as one calculated to improve the usefulness of those engaged in the industry, and pledges itself to support the scheme."

MURRAY'S IMPROVED COMPLETE GASIFICATION PLANT.

By E. F. MURRAY.

The aim of gas engineers, inventors, and designers interested in the water-gas practice has been, for the last fifty odd years, to design and construct an efficient apparatus, working on the principle of complete gasification. Therefore whatever fuel is charged into the plant, the object is to get the utmost thermal value out of the charge in the form of gas produced, without heat losses, and as near as possible true to the theory of the process. To obtain this result, the apparatus must be designed and constructed to give the highest heat efficiency—meaning that it must be capable of creating, conserving, and utilizing every heat unit necessary to produce the heat required for the chemical reactions, but in such a manner as to supply heat only, to maintain the heat-balance in the various zones of the apparatus, by making good the heat units lost during the dissociation and association of the elements, and to supply the heat required as heats of formation.

In a well-designed apparatus, having a well-designed grate and a suitable depth of fuel, it is an easy matter to secure nearly perfect combustion in the generator and to blow the fuel bed to the requisite incandescence even with a moderate blast; and if the retort over the generator is of moderate sectional area and length,



the internal thermo-chemical performances can be localized and kept under positive control. At the present time, the more or less general practice in various combined apparatus, and when using coal as fuel, is to attempt to carbonize the coal in the retort by external heating; in some cases, by picking-up the sensible heat of blow-gases during the blow, storing it in regenerative chambers, and expecting to regain this heat by radiation and at high intensity during the period of gas making; in other cases, by additional bye-passing of water gas from the generator, and burning it in the space that surrounds the retort.

Now it has been established by thorough practical tests that the heat penetration through the retort wall into the fuel column, even under the best possible conditions, is barely a few inches, and hardly sufficient in intensity to supply the "finishing" temperature of carbonization (especially required at the bottom part of a vertical retort) to a large volume of fuel, and to supply dry coke of carbon value only to the generator. To obtain even a partial result, the size of the regenerative chamber able to take up a heat-absorbing medium of sufficient weight and surface would have to be made so large as to be quite out of proportion to the size of the actual reaction space of the apparatus, and the heat transfer could not be controlled.

Should any additional combustible gas be supplied (water gas) and burned to maintain outside heat in a moderate-sized regenerative chamber during make, local heating and consequent hanging-up in the retort is likely to occur. Besides, to carry out this construction, the employment of various complicated dampers is needed, and there is a danger of "short circuiting." Further, this combustible gas can be employed to its full value in a more useful and effective manner. The sensible heat of the blow-gases can be utilized, but in another direction.

In most apparatus the "up-run" make of gas is taken off at or near the extreme top of the retort out of a very small space over the fuel, and in some cases the gas outlet opening is actually in contact with the green fuel charge. Consequently surface moisture and tar vapour is carried off with the "make" to be precipitated as condensed matter in the seal-box, cleaning system, and conduits. Water-gas tar is not a useful commodity once it gets outside the apparatus, and besides lowering the heat efficiency of the retort by the absorption of heat as the latent heat of vaporization (which is afterwards lost in condensation), it carries off a great percentage of the unsaturated volatile hydrocarbons to the calorific detriment of the final make of gas—ultimately proving itself a contaminating nuisance at the purifiers. During vaporization, and as a vapour—especially in a small confined space—tar also retards the active decomposition of the unsaturated volatile hydrocarbons, causing the make of gas to remain "unfixed." Therefore, though a plant will produce a large volume of "make" at the outlet pipe, this will be of unstable composition, and when measured at the holder its original volume will be found considerably reduced.

Now this tar or tar vapour can be retained in the apparatus itself and converted into permanent gases—a great step towards complete gasification. Carburetting by the addition of liquid hydrocarbons is carried out in some cases by forcing or trying to force heavy liquid hydrocarbons through a nozzle into the incandescent fuel bed in the generator; but more often than not, this does not penetrate into the incandescent strata at all.

It is quite simple to understand that the incandescent surface exposed to the liquid hydrocarbon spray is comparatively small, and it must be kept small to prevent the incandescent fuel spreading into the carburetting opening, and also to confine the horizontal cross-sectional area of the generator to a simple form to ensure uniform blast penetration and blast travel through the fuel bed. So the heat contained in the small volume of incandescent fuel forming the base of the exposed surface is not adequate to decompose the precipitated liquid hydrocarbons, the surface cools rapidly, and the heavy liquid hydrocarbons will "cook" into a cake of tar clinker. This tar clinker will prevent any penetration into the fuel bed of the globules of the sprayed-in hydrocarbons, and will often also prevent the fuel gravitating from above freely into the generator—with the result of the formation of pockets and secondary combustion zones in the fuel bed, rapid local combustion during the blow, and great loss of CO.

In some other systems, where a superheater for oil carburation is used, good results have been obtained when using gas oil. Still, apart from the heavy extra first cost of a separate structure and connections, the additional space required for same, and the heat units lost through radiation due to the necessarily increased radiating surfaces in the plant, the full calorific value of the introduced liquid enrichments can only be secured if the generator is run on a fixed period of blow, giving perfect combustion, or if the superheater is kept at the requisite temperature by the combustion of water gas taken from the generator and applied on the system of recuperation.

It is easy to understand that in order to obtain perfect decomposition and fixing in a superheater by the utilization of the sensible heat of the blow gases only, and without unnecessary waste of heat, it is essential that the size of the superheater shall be in fixed proportion to the size of the generator, depth of fuel, pressure of blast, and the length of blow period, and that the superheater is supplied with the necessary volume of gases of combustion carrying the required heat units as sensible heat.

Should the blow period be shortened, and so be out of tune with this fixed proportion, or should the supply of sensible heat fall, due to imperfect combustion in the generator, then the expected decomposition of the hydrocarbon vapours will not take place, there will be change of vapour tension of the make in passing through, and over-distillation of undecomposed saturated vapours. To heat the superheater by water gas tapped hot from the generator is "robbing Peter to pay Paul." The sensible heat of the blow gases used in heating-up the superheater may also be utilized for a better purpose in a waste-heat recovery system in conjunction with steam-raising and steam superheating.

Then there are systems of carburetting by injection of liquid hydrocarbons into the hot blast chambers. This operation is single acting, and can only be employed on the down run, and with light fractions. As for carburetting by introducing hydrocarbons, especially lighter fractions, at the top of the retort close to the gas outlet, it is a desperate effort, and is only a "game of distillation."

A plant for small units (50,000 c.ft. to 300,000 c.ft. daily gas production), in which novel features are embodied, is put forward here as an improvement on some of the existing systems. It is claimed that the apparatus will work true to the principle of

"complete gasification," and that the system will permit a positive control to be maintained in the various zones of the retort and generator. It is operated on the usual water-gas plant principle, with alternate "blows" and "runs"—a method of procedure and performance which is too well known among gas engineers to require description.

The chief novel features embodied in the apparatus are as follows:

(1) The actual carbonization of the fuel in the retort (4). The extraction of all the volatile matter and production of coke with "carbon value" only, for the generator (5), is performed by the *sensible heat of the ascending high-temperature water gas*, which is acting as solvent in the fuel column. Not only is perfect carbonization obtained by this means, but the length of carbonization period is also reduced; and as the generator is designed for flexibility and for great reserve power to supply water gas even above the required volume and at an intense temperature to overcome the internal heat resistance of the mass of fuel in the retort, this method of carbonization will convert the whole of the fuel into coke—not semi-coke, to be drawn during clinkering as "coal" which has been subjected to a process of partial distillation and partial combustion.

Although part of the sensible heat of the blow gases is utilized for external heating of the feed and primary vaporization chamber (2), no carbonization is aimed at by this means, and the blast chambers (13), filled with checker-walls, are acting only as "hot radiating lagging" to the retort, This latter provision is made with a view to maintaining the heat-balance between the inside and outside of the retort, and in this way preventing loss of heat by radiation through the retort walls.

(2) To make the carbonizing performance of the ascending water gas easier and more effective, and to retain and utilize all the volatile matter contained in the fuel for gas production, the make of gas *is not taken off at the extreme top of the apparatus*, but at a lower level, having a column of fuel interposed between the feed level (2) and the gas-outlet ports (23). This interposing column of fuel forms a neutral zone, and is adjusted to separate the gas outlet and primary vapour formation levels.

The retort proper for actual carbonization begins at the gas-outlet ports (23), while the feed chamber (2) is acting as primary vaporization chamber. This vaporization chamber is heated from the outside by the sensible heat of the blow gases, and also receives some heat by convection from the fuel in the retort. It is utilized for driving-off the surface moisture and tar from the green fuel charge; the temperature inside it being kept just high enough for this purpose.

By removing the tar and physical moisture from the fuel at this stage (which constituents vaporize with high initial pressure of vapour formation, forming vapours of great density), the fuel will reach the retort proper without top strata saturation; and the carbonizing duty of the ascending water gas will be to deal with the ethylenic hydrocarbons, middle and heavy fractions, only. As these can now volatilize freely, the length of carbonization period is reduced; and, besides, the final make of gas is free from tar.

After the tar is vaporized in the primary vaporization chamber, it is passed without any loss of its sensible heat or drop in its vapour tension to carburetting chambers (21) located in the generator at the incandescent zone level. In the carburetting chambers the complex vapours are blown against refractory baffles kept at red heat by contact with the incandescent fuel, the tar vapours are cracked into permanent gases, the water vapour will combine with the carbon residue of cracking and will form water gas, and the resultant gases as enrichment will pass into the retort to mix with the other gas produced.

The physical moisture driven off as water vapour is acting in the primary vaporization chamber, during the passage of the complex hydrocarbon vapours to the carburetting chamber, also in the carburetting chamber itself, as an endothermic medium, and will prevent the over-cracking of any of the volatile hydrocarbons, a certain volume of which is bound to come off with the tar vapours.

When introducing additional liquid hydrocarbons for higher enrichment of the make of gas, the liquid hydrocarbons are forced by superheated steam through nozzles into the feed and primary vaporization chamber, entering perfectly atomized. In this chamber they are vaporized, and passed on to the carburetting chambers.

(3) The final make of carburetted water gas contains a large percentage of volatile ethylenic (unsaturated) hydrocarbons. These volatiles are subject to easy change of vapour tension, and are condensable, causing the final make of gas to be "unfixed." To produce a "fixed" final make, the gas is passed through vertical fixing conduits (24), kept hot by checker-walls, which were heated during the blow by the passing blow gases. In these fixing conduits the ethylenic hydrocarbons are decomposed by heat, forming methane, benzene, &c., and causing the gas produced to issue "fixed." Any soft carbon deposited during the process of "fixing" is partly decomposed and partly swept down into the generator by admitting a small amount of steam (31) during the down run.

The claim of the designer of the plant is that in the apparatus all carbon and volatile values contained in the fuel are utilized in the process of gas production, without any bye-products of doubtful value; the sole aim being to produce gas clean, fixed, and of high calorific value.

THE FINE CHEMICAL INDUSTRY.

UNDER the title of "Shall the State Throw Away the Keys?" the Association of British Chemical Manufacturers have published an interesting pamphlet, which constitutes an exposition of what fine chemicals mean to the nation. There is a foreword by Sir William J. Pope, K.B.E., F.R.S., Professor of Chemistry in the University of Cambridge, and President of the International Union for Pure and Applied Chemistry. It is well, now that we are at the opening years of another chapter in the history of our country, that we should weigh the advantages and disadvantages of the national situation and resources, and apply the experience of the past to the continued development of our great national heritage. Taken in the whole, the pamphlet is an argument for not allowing this country to relapse into a state of dependency for many essentials upon Germany. The peril in which we stood in 1914 is too astounding for that to be allowed; and yet the danger is at our very doors. For example, the production of explosives was hampered because we had but little plant for making fuming sulphuric acid; and the steel industries were endangered because Germany had a monopoly in the supply of the rare metals which are essential components of hard steels. In his foreword, Sir William Pope points out that the question of whether this country will or will not build up a sufficiently organized and completely interlocked fine chemical industry, is a perpetual subject for discussion in the German technical journals. If we do not succeed in this, then we shall have once more to rely upon the German factories for the supply of vital materials for our industries; and should another great European war break-out, we shall not be accorded leisure for improvization.

In the pages of the pamphlet, many instances are given in illustration of the fact that a fine chemical industry is essential to the continued success and development of all our great manufacturing industries. There are chapters on general medicine and public health, tropical diseases, surgery, synthetic perfumes, photography, industry, solvents and varnishes, and analytical reagents. The use in industry of rare earth fine chemicals is specially interesting. The rare earths—cerium, thorium, vanadium, molybdenum, and the like—were until recent years known only as scientific curiosities. Chemical research has now endowed them with applications of such a practical nature that no country can keep abreast of the march of progress without making use of them. The writer asks the reader to consider for a moment the number of incandescent gas lights which are in use to-day. The incandescent gas-mantle industry is absolutely dependent on the fine chemicals, thoria and ceria, which are derived from the rare metals contained in monazite sand. Without these rare earths, we should have been condemned to the old fish-tail jet which was once so familiar. But when the chemicals are prepared in a state of great purity and blended in certain proportions and made into a mantle, millions of people reap the benefit in better health and illumination, and economically. The use of rare metals for the preparation of special steels and alloys forms one of their most important applications. The addition of such metals as vanadium, tungsten, molybdenum, &c., even in small proportion to steel, modifies its properties, and some of the special steels thus obtained have very valuable applications. Thus, by the addition of metals which check corrosion, "stainless steel" is obtained; and this is the origin of the stainless steel knives in use for the table to-day. Other mixtures have great mechanical strength combined with ductility, and are suitable for engine-parts. Others withstand high temperatures without softening—a property which is invaluable for high-speed tools. Others, again, have high magnetic permeability. These properties are being taken advantage of in a continually increasing degree, on account of the economies which they offer. Without fine chemicals it would be impossible to manufacture these steels. Other practical directions in which the rare earths have developed are the preparation of glasses and enamels, highly refractory zirconia crucibles for metallurgical work and cerium alloys for igniters. Further research is continually bringing new applications to light; and it would be folly to ignore the opportunities offered by the rare earths.

In the chapter on fine chemicals as analytical reagents and their use in industry, there is good argument for development in this respect. There is insistent need of chemicals for research purposes. It is admitted by all that the true feeling for research is possessed in rare measure by our race; therefore it is of great moment that we should render ourselves as far as possible independent in the matter of supplies of research chemicals, and produce such a large variety of compounds as will render it the easier for our men of science to carry on their experiments with the greatest possible readiness and rapidity. The development of the fine chemical industry would render it more and more possible to produce in this country the research chemicals which are required. As the result of what has been achieved so far, several thousands of different chemicals are now available. This is, indeed, a great achievement. It is claimed that this has been reached more by a determination to render this country independent than by any hope of gain. Without national support, the venture will fail to become self-supporting, and those concerned will perforce and regretfully have to abandon it.

Copies of this interesting pamphlet, only parts of which are reviewed here, can be obtained from the Association of Chemical Manufacturers, No. 166, Piccadilly, London, W. 1.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Waddon Works of the Croydon Gas Company.

The first visit of the Association for the present session took place last Saturday afternoon, and turned-out a great success. About a hundred of the members, accompanied by the President, Mr. D. Cleave Cross, of Lea Bridge, were the guests of the Chairman and Directors of the Croydon Gas Company, and of Mr. A. Caddick (the Engineer), at the well-known Waddon Gas-Works. Of course, the Association had been there before. It was impossible that, having been in existence for so many years, they could until now have overlooked so important a works. But the Waddon works—or those responsible for their administration—never stand still; and in the seven years which had elapsed since the previous visit and the present one, many extensions and improvements had taken place. There was much of value—far more than can be noted in this brief account—to be seen and heard during the inspection; and Mr. Caddick allowed it to be seen and heard with absolute freedom and thoroughness. In fact, he entered into the spirit of the whole thing in a manner that completely won the approbation of all. No one can have come away without having added something to his store of knowledge—which is the main justification for describing the visit as a great success. The spirit of orderliness and cleanliness everywhere prevailing was noticed by all; and therefore it was no surprise to hear Mr. Caddick lay great emphasis on the importance, from every point of view, of paying special attention to these matters.

As early as possible, the members assembled at the north entrance to the works, and were promptly taken in charge by Mr. Caddick and a number of his staff—Mr. Geo. W. Tatam (Assistant Engineer), Mr. S. Ringham (Second Assistant Engineer), Mr. George Tebbs, and Mr. J. Wooley—and by them escorted over as much of the immense site as was practicable in the two-and-a-half hours of daylight which remained. When it is stated that the Waddon works now cover about 42 acres of land, it will be understood that the inspection could not embrace everything; but the most in every way was made of the time at disposal, and of such things as they could not actually see for themselves, the members were able to learn from a booklet which had been prepared by Mr. Caddick. For the large amount of extension work that has been undertaken, the necessity is at once realized from a glance at the gas output figures. In 1896, for example, the total quantity of gas sold by the Company was 592,977,000 c ft.; and in 1909 it was 1,257,000,000 c.ft.; while for 1921 the make was 2,120,037,000 c.ft. The Company have a statutory area of supply of about 80 square miles, of which approximately only one-half is built upon; and as the greater part of the remainder is suitable either for residential or business development, it will be seen how large a scope there is for further expansion of the Company's output. It may be mentioned that at the present time the Company supply, through more than 300 miles of main, the requirements of 52,000 consumers, who hire over 50,000 cooking and heating stoves, besides a number of fittings and other appliances. Out of this number of consumers, 25,911 are supplied on the prepayment meter system. Under the Gas Regulation Act, the declared quality of the gas was fixed at 470 B.Th.U., and the price at 13·2d. per therm, equal to 5s. 2·04d. per 1000 c.ft. This was (following the expenses occasioned by the coal strike of 1921) advanced during that year to 13·8d., equal to 5s. 4·86d. per 1000 c.ft. Since then, successive reductions have been made; and the price is now 11d. per therm, equal to 4s. 3·7d. per 1000 c.ft. These reductions are, in all, equal to 13·16d. per 1000 c.ft., which represents a gain to consumers of practically £100,000 per annum. The dividends on the sliding-scale stocks, which had during the war been reduced by £17,250 per annum, are now of the pre-war amount.

The works are well served by the London Brighton and South Coast Railway. Coal is brought by steamer to the Thames, and thence by rail to the sidings adjoining the works; and these are connected to the various railroads, and also by embankments to the elevated railway running through the covered coal-stores from each end of the works. These stores, which adjoin the retort-houses, are capable of containing about 12,000 tons; and there is in the autumn usually a further 10,000 tons stored on the open ground—this latter being handled to and from the railway trucks by two steam grabbing cranes. The whole of the coal and the residuals, with other materials required for the running, maintenance, and construction of the works, is handled by the Company's three locomotives. There are about 3200 yards of single-track standard gauge railroad on the works. For the maintenance of the machinery and plant, there are good smiths' and fitting shops, replete with the necessary machine tools and staff, capable of dealing with any immediate breakdown.

The works comprise two entirely distinct sections of coal-gas carbonizing and purification plants. Each is a complete unit in itself; but they are inter-connected for convenience of manufacture and working. There are four retort-houses—Nos. 1 and 2 being included in the first section. No. 1 house, completed in 1867, has during the last two years been considerably modified and adapted to modern conditions, to obtain the utmost carbonizing capacity. It contains fourteen settings of ten retorts, 22 in. by 16 in. ⊓ shaped, 20 ft. through, in five tiers. The charging and discharging is by Drakes' latest patented type of electrically-driven combined machine, controlled by one man. The charging is operated by centrifugal force, by which the coal is projected into the retort in any desired quantity within its capacity, the limit being about 14 cwt. Discharging is by a ram-head pushed into the retort by a form of interlocked chain, driven from a large sprocket-wheel; the coke falling into the "Croydon" conveyor on the opposite side of the house, by which it is taken to the storage hoppers outside. Coal is received from the high-level railway into the adjoining store, passed through crushers, and elevated into two storage hoppers, each of which holds about 75 tons. The coke, when elevated by the conveyor to the top of the storage hoppers, is discharged upon jigging-type screening conveyors, and graded from dust to large coke into the various compartments, from which carts or trucks may be loaded direct. The whole of the machinery is operated by electric power. The retort settings, coal and coke plants, and the stoking machine were constructed by Messrs. Drakes, Ltd., of Halifax. The ferro-concrete coke hoppers and the stage-floors of the retort-house were made on the Indented Bar Company's system.

No. 2 house, erected eight years later, was almost entirely rebuilt and enlarged in 1908. There are in this house fifteen settings of ten retorts, 22 in. by 16 in. ⊓ shaped, 20 ft. long, in five tiers, operated by West's stoking machines driven by compressed air. There is a charging machine on each side of the bench, and a separate machine on one side for discharging the coke from the retorts, from which it is delivered into a West conveyor and discharged into a skip capable of holding about a ton, which, when filled, is lifted by means of a 2-ton "Stothert and Pitt" electric crane to the coke storage hoppers. The crane runs on a gantry on the top of the coke hoppers, and the full skip is either emptied direct or may be dropped into the yard on the far side, should the hoppers be full. These hoppers are provided with outlets which discharge the coke on to two Marcus screening conveyors, by each of which it is possible to screen and load into railway trucks at the rate of 30 tons per hour. Other outlets are arranged to discharge upon jigging-type screening conveyors, delivering screened coke into carts and sales hoppers. There are also for use, when necessary, coke-cutting machines for making broken coke, complete with their own screening conveyors. The machinery in connection with this house, with the exception of the compressed-air driven stoking machinery, is driven by electric power. For the quenching of the coke in Nos. 1 and 2 houses, water is sprayed at a pressure of 60 lbs. per sq. in., obtained by two electrically-driven Tangye pumps; the water being collected in underground storage tanks and re-circulated.

The condensers, washers, and scrubbers are housed in one building. The "Eclipse" condensers are of the water-tube type, constructed by Messrs. Clapham Bros., and are arranged to be worked singly, in rotation, or in parallel, the flow of gas and water being reversible. The circulation of the water is automatically controlled by two Tangye electrically-driven "Tan-gyro" centrifugal pumps, one of which takes its supply from the reservoir under the cooling tower and delivers to an overhead supply tank above the condensers, while the other draws the water from the condensers through a receiver, and delivers it over the cooling tower some 250 yards away. There are four Donkin exhausters, the steam-engines being of the compound condensing Farey type. The two Lancashire boilers supplying steam for this section are fitted with forced-draught furnaces for the burning of coke breeze and dust. Upon leaving the exhausters, the gas returns to the condenser house, and passes through a series of Livesey washers to the steam-driven "Standard" washer-scrubbers, and on to the nine purifiers. There are two station-meters by the Gas-Meter Company.

Coming now to the second section, it may be mentioned that No. 3 retort-house was built in 1893; but in 1904 No. 4 house was erected, and the two thrown into one. The first contains fifteen settings on the Drake regenerative system, and the second fourteen settings on the West system—all of eight retorts, 22 in. by 16 in. ⊓ shaped, in three tiers, 20 ft. through. Charging and discharging is by two West compressed-air driven stoking machines, one on each side of the benches, and a ram discharger on one side only. Coal is brought into the stores on the high-level railway, and unloaded direct into the breakers beneath, being subsequently elevated by four sets of steam-engine driven elevating machinery into the overhead storage hoppers. The coke is dealt with by two sets of De Brouwer conveyors on one side of the benches, carrying it away as pushed from the retorts to cross conveyors, which elevate it to jigging-type screening conveyors on the top of two storage hoppers outside the houses, by which it is graded from dust to large coke. The coke-handling plant is driven by "National" gas-engines.

Here, again, the condensing and washing are carried out in one building. For the "Eclipse" water-tube condensers, the cooling water is pumped by automatically controlled steam-pumps from No. 4 gasholder tank. It returns by gravity, and is cooled before entering the tank by an open-type cooler. From the two Donkin exhausters (driven by horizontal compound Farey steam-engines) the gas passes through two Livesey washers, and then to the two steam-driven Kirkham "Standard" washer-scrubbers. In the central bay of the purifier-house there are six purifiers, each 40 ft. square, with four covers. These covers are secured by Milbourne fasteners, and fitted with "Eclipse" rubber joints. Four boxes are arranged to work in rotation or otherwise, while the

other two are catch boxes; and all are operated by Milbourne valves. The house is of the open-sided type, in three spans, supported upon columns; the two outer bays being for revivification and storage of oxide of iron. An overhead traveller is installed, capable of lifting two covers at once. In the meter-house is a Thorp and Marsh rotary meter. The three Lancashire boilers are fitted with forced draught furnaces and "Northern" fire-bars for coke dust and breeze burning.

The four sets of Humphreys and Glasgow carburetted water-gas plant have been enlarged so that each set is now capable of producing 1 million c.ft. per day. There has also this year been installed a blue water-gas plant of 1½ million c.ft. daily capacity. The last-named has a waste-heat boiler capable of producing the necessary amount of steam for its own section of plant. Screened coke is brought from Nos. 3 and 4 retort-houses by a De Brouwer conveyor, and stored in a line of overhead hoppers above the operating floor, and from these taken by bogies to the generators. In the same block of buildings is the necessary air blowing plant, consisting of two "Buffalo" fans, belt driven, with Marshall horizontal reciprocating engines, one Sturtevant fan driven by a De Laval steam turbine, and one similar (but larger) set in the adjoining pump-house, where also are the necessary pumps in connection with water circulation, oil supply, &c. The exhausting plant consists of two Waller and one Donkin exhausters, direct coupled to steam-engines. The gas passes to the relief holder, and is dealt with by the exhausters previously mentioned, passed through a "cyclone," Livesey washers, and into either of the two sets of purifiers, or can be split into two streams. Each set consists of four boxes worked in rotation, with a catch-box. One set is of the water-lute type, and operated by a Weck change valve. The other set, which has this year been completed, is of the luteless type, and is built of ferro-concrete, each box being 33 ft. by 25 ft., fitted with two steel covers and "Eclipse" rubber joints. They are operated by Pickering change valves. Travelling "Goliath" cranes, running on rails, are installed for lifting the covers. The one on the old set of boxes is hydraulically operated; the other is a Herbert-Morris chain block type. The gas then passes to the meter house, where it is measured by two station meters; one of the Gas Meter Company's wet type, the other a Thorp and Marsh rotary meter. Thence it goes to the valve-house, where its mixture with the coal-gas is effected in the inlet cylinder.

In the central boiler-house there were until recently five Lancashire boilers, fitted as those previously referred to; but two are being superseded by Babcock and Wilcox water-tube boilers of more than treble the capacity. These are to be fitted with latest compartment type, forced draught, chain grate mechanical stokers for the burning of coke breeze, which, together with the forced draught fans, are motor driven by electric power. The total steaming capacity of all the boilers in the house will be about 40,000 lbs. per hour. In the main flue a Green's fuel economizer is installed for heating the feed water.

Adjoining the boiler-house is the air-compressor house, where there are three sets of steam-driven West's horizontal, single-line, two-stage air compressors. On the floor above is a "Criton" water-softening plant, capable of reducing the warm water used, by chemical treatment, to about 4° hardness, and complete with a "Torrent" filter. On the top of this building is the overhead water storage tank of a capacity of about 130,000 gallons, divided into three compartments, one of which is used for the cold water delivered from the wells. This water is used almost exclusively for the cooling of the gas passing through the water-gas condensers. On leaving these, the resultant hot water is pumped up into the other two compartments; and it is from these that the water-softening plant takes its warm supply, the remainder being used for other services on the works. At the extreme north end of the works is No. 3 well. This was bored in 1913, and provides the main supply of water required for works purposes. An 8-in. 100 ft. deep well pump, driven by gas-engines, is installed.

There is an excellent electric power house for the various motors on the works; but Mr. Caddick has also arranged to take current from the Corporation mains under conditions which he explained when addressing the visitors later. From the two coal-gas sections and the water-gas plant, the gas passes to the valve-house, where all the mains are connected to a 48-in. diameter inlet cylinder, and from this also are connected the inlet mains to the holders. The outlet mains from the holders are connected to a similar outlet cylinder, from which a 30-in. main is taken to the booster-house. A Cowan automatic bye-pass safety governor is fixed between these two cylinders.

Owing to the large area of supply and to the increased pressures becoming necessary on the district mains, the booster-house was built in 1906. There are two Sturtevant booster-fans or pressure raisers, driven by 60 B.H.P. De Laval steam-turbines. Each is capable of delivering 650,000 c.ft. of gas per hour at a pressure of 15 to 18 in. water gauge. There has also recently been installed a Rateau fan, driven by a 260 B.H.P. Terry steam-turbine, this set being capable of delivering 1,500,000 c.ft. per hour at a pressure of 40 in. water gauge. From these the gas passes through a "Hastings" carburation cylinder for the elimination of naphthalene, and thence onwards to the governor-house in which are two and three Cowan governors respectively. There is also connected through one governor-house a main under ungoverned pressure direct to the holder and distribution station at Whyteleafe, a distance of over 5 miles. For the purpose of maintaining the pressure in the Beddington, Carshalton, and Wallington districts, there was installed in the latter part of 1920 a system of high-pressure distribution, the gas being taken from the outlet cylinder in the valve-house and compressed by an automatically controlled, electric motor driven, Alley and MacLellan "Sentinel," two-line single-stage compressor, capable of delivering 80,000 c.ft. of gas per hour at any pressure up to 50 lbs. per sq. in. This ingenious automatic control received much attention and commendation at the hands of the visitors.

In addition to the water-gas relief holder already mentioned, there are four holders on the works. The latest (under construction at the time of the last visit) has four lifts, and is contained in a tank 226 ft. in diameter by 46½ ft. deep. It has a total capacity of 6,780,000 c.ft., and is built entirely of steel, of which nearly 2500 tons were used in its construction. The holder rises when fully inflated to a height of 207 ft. above ground level, and is the largest in the South of England, outside London. The tank of brick and puddle was built by Messrs. Thos. Vale & Sons, Ltd., of Stourport, and contains 8½ million gallons of water. The holder was commenced in December, 1914, and continued until the autumn of 1915, when, owing to the exigency of the war, work was stopped, and not again commenced until Midsummer, 1919. It was completed for use by October, 1921. The construction was carried out by Messrs. Ashmore, Benson, Pease, & Co., Ltd., of Stockton-on-Tees. One of the Lancashire boilers recently removed from the central boiler-house is about to be installed near this holder, to supply the steam necessary for prevention of the freezing of the cups in winter.

The arrangements for the testing of the gas are of a very complete character. The sulphate of ammonia plant is of the Chemical Engineering Company's most modern type, arranged in two units of 7 tons and 5 tons per day; and open heaped oxide of iron purification is resorted to for dealing with the waste gases. A Hird Chambers and Hammond continuous tar dehydration plant is capable of dealing with 30 tons of tar per diem; and during the war a Simon Carvés distillation plant was used in connection with creosote oil washing of the coal gas for crude benzole. There is excellent canteen, club, and mess-room accommodation on the works, as well as a good sports ground. The stove repairing department is replete with everything necessary for the work.

The tour of inspection completed, tea was served, and at its conclusion,

The PRESIDENT said those who were present must congratulate themselves on having seen what must be one of the most interesting works round London. There was nothing "cut and dried" about the works; the management were out to try everything new. The very full booklet distributed among the visitors had been well prepared and contained information that would repay study. The remarkable appearance of the engine-rooms alone was really a tribute to Mr. Caddick, who had also shown his broadmindedness in his resolve to take current from the Corporation at times when he could obtain it cheaper than he could generate it on the works. Everything they had seen and heard emphasized the fact that the Company were alive. They must all have gained much useful knowledge from the visit.

Mr. W. GROGONO proposed a hearty vote of thanks to the Directors of the Company and to Mr. Caddick, for all the trouble that had been taken and for the hospitality extended to the Association. He complimented all concerned upon the policy pursued at the works, and said everything pointed to the fact that at Waddon they were something of a "happy family."

Mr T. V. JOHNS, in seconding, made special reference to the waste-heat boiler, and said he thought in a few years' time they would have the red-hot coke going into the generator, so making the water-gas process more efficient still.

Mr. CADDICK, in response, said the members of his staff and he himself were very pleased to see the Association there. Seven years had elapsed since their last visit; and he hoped it would not be so long before they saw them again. In 1915 the Company were really in a state of transition; but things had got straighter now. The large new holder, in particular, was a great comfort to them. He was a great believer in cleanliness and tidiness. If they put a man into a tidy room, he would keep it tidy and would take a greater interest in his work. Therefore it paid to look after these things. A man worked much more comfortably, also, in clean surroundings; and he did not see why a gas-works should be such a terrible place as many people thought it. Unless the space was very cramped, a gas-works could be kept clean, and tidy, and healthy. In connection with this, he pointed to the fact that the many fine chrysanthemums in the room were all grown on the works. Mr. Caddick then proceeded to compliment Mr. Cross very highly on his recent Presidential Address, and said that gentleman had based his remarks upon the argument that little things count. This was a fact, and it was astonishing how one could make big things out of little. The seniors had to depend very largely upon the juniors of the profession in regard to matters of detail, and seeing that everything was kept up to date. He had been pleased to see in the "GAS JOURNAL" the very good suggestion that there should be a closer relationship or bond between the two classes of Association, for in this he thoroughly believed. The more the seniors and juniors mixed together, the better it would be for the undertakings they served, and for themselves. There ought to be no special line of demarcation between Associations of this kind. With co-operation, nothing but success could lie before them. He remarked upon the great benefits to be derived from such meetings as they were holding that day, and said he did not think they visited each other's works enough. He believed that in this way one could learn more than from many of the papers written. His works were always open to anyone. Though he had been connected with gas undertakings for some 38 years, went on Mr. Caddick, he was still learning something nearly every day. They must go on learning themselves and instructing the public—the matter of therms was a case in point. In the

Waddon works they had had to adapt themselves to altered circumstances. They had been forced to carry out extension work at high prices, because they could not afford, with their rapidly growing consumption, to wait until prices came down. However, they got everything done as cheaply as they could in the circumstances. A good deal of repairs had also to be undertaken; but 8d. per 1000 c.ft. of gas sold had been their highest figure for works repairs account. In normal times it was a great mistake to let works run down. In this respect they should never put off until to-morrow what they could do to-day. If they did, they would be faced with a heavy expenditure at some time or other. With regard to electric power, it was a fact that they had recently connected-up with the Corporation mains. The first consideration was that they might have a stand-by in their own power house. Being so much dependent upon electric power, this was most important. Also they used the Corporation current during certain hours of the day when they could get it more cheaply than they could generate it themselves. He wanted to sell gas as cheaply as possible, and this was one of the means of lowering the price. The town possessed one of the most efficient electrical plants in the country; and he felt that he was perfectly justified in taking what he wanted from it during the cheapest hours. From 2 o'clock until 10, when the price was 4d. per unit, they ran their own plant at the gas-works; and during the remaining sixteen hours, when the price was 1·2d. per unit, they took the current from the Corporation. In the matter of reinforced concrete, they had been faced with the problem that, after the war, the tenders for steel-work were very much in excess of the cost of reinforced concrete. Therefore the latter was decided upon for some purifiers. He was rather chary about adopting this course, because he had heard disappointing accounts from some works. They at Croydon had used super cement, and had given the purifiers a coating of dehydrated tar. Tested under 40 in. pressure, beyond a few small bubbles on the crown of some of the boxes, they were perfectly sound. The purifiers had been working now for a couple of months, and he had perfect confidence in them. Mr. Caddick went on to mention that the Company were increasing the calorific power of their gas—because they thought it would be the right thing, and not just because others were doing it; and they were going to watch very carefully what took place when the alteration was made. The calorific power they were under now was 470 B.Th U., and they were going to raise it to 500 B.Th.U. They had been on the question of inerts for some considerable time. Their chemists had been hard at it testing various qualities of gas—particularly in connection with inerts. He thought to-day the Company's average was 15 or 16 p.ct. of inerts or incombustibles, including oxygen. With this figure, they had been able to increase the height of the flame in their gas-fires. When the inerts were up—as they had been in war-time—to 22 to 25 p.ct., he had found that the flame in particular gas-fires that he watched and allowed no one to interfere with did not reach the top of the fuel by about an inch, at (say) 35-10ths pressure; whereas now, with 15 or 16 p.ct. of inerts and the same calorific value, the flame came to the top of the fuel without any air adjustment being absolutely necessary. In conclusion, he said that if ever members wanted any further information, or would like to visit the works in parties or singly, he would, on hearing from them, be pleased to meet them or tell them what they wanted to know.

CANADIAN GAS ASSOCIATION MEETING.

(*Concluded from* p. 163.)

In addition to the brief abstracts of papers contributed at the annual convention of the Canadian Gas Association which were given in the "JOURNAL" for Oct. 18, and those which will be found below, there was one by Mr. F. W. Fisher, dealing with the prevention of accidents on gas-works, of which a notice appeared in our issue dated Oct. 4, p. 51.

SULPHIDING OF METALS IN GAS KILNS.

It has been found by Mr. B. B. Saul, who is Chemist to the Montreal Light, Heat, and Power Company, that the industrial use of gas-fired kilns has presented a problem in the form of a chemical reaction occurring between the impurities in the flue gases and the articles in the kilns during heat treatment, whereby discoloration takes place. With the process of making silver deposit decorations on glass, a decidedly yellow coloration may occur in place of the natural silvery-white appearance; and a satisfactory solution of this difficulty was imperative, if gas was to be continued in use by the firm concerned.

It was gathered that the difficulty appeared periodically, and was most pronounced in calm and humid weather; and it was decided that the flue gases had at least something to do with the yellow coloration. Apparently the sulphur dioxide produced by combustion of the various sulphur impurities in the gas was absorbed by the alkaline paint, which, by reason of the reducing atmosphere, was partially converted into sulphur, and the latter reacting with the potash in the glass produced what is known as "liver of sulphur." The composition of this liver-coloured mass is variable, and depends upon the proportions in which the bodies have been mixed, and the temperature of fusion. Obviously, then, the flue gases must be kept away from the interior of the muffle, if this discoloration is to be avoided. It was difficult to keep the door of the kiln sealed, because the remainder of the paint vehicle had to be driven off, and an outlet for its escape provided; and, besides, this was the customary way for the operator to observe the progress of fusion. What was done was to construct a vent connecting the interior of the kiln with the flue—thus acting as an outlet for the turpentine vapours, and thereby allowing the door of the kiln to be kept sealed during the beginning of the operation. By extending the height of the chimney, sufficient draught was obtained to draw away the flue gases, so that the occasional opening of the kiln door did no harm. Since the carrying-out of these minor changes, no complaints have arisen from this source.

In making a bifocal lens—in which process a fusion is brought about between a disc of flint glass and crown glass—it was found that, after fusion and grinding, the flint glass was slightly opalescent. Again the solution consisted in excluding all flue gases from the interior of the muffle. But in this case it was more difficult. A higher temperature, and consequent higher velocity of the burning gases, led to some of the flue gases finding their way through the pores of the muffle. At that time the inner muffle was constructed of carborundum; and it was not until a ni-chrome steel muffle was made that entirely satisfactory results were obtained.

A GAS-METER INVENTORY.

The plan and purpose of an inventory of meters was outlined by Mr. Charles Scott, of the Application Department of the Consumers' Gas Company of Toronto. He described the Company's meter record file, the information it contains, and the method of operation. The file has approximately 160,000 white cards, the size of which is 4 in. by 6 in. The size of the meter, the Company's number, and the maker's number and name appear at the top of the card; and below this it is divided into columns, headed as follows: Consumer's name and address, on and off dates, and meter-shop tests and Government inspection. The cards are filed in numerical order, and are sub-divided by tab cards. Every fiftieth number is distinguished by a pink card, the hundredth number by a blue card, and the thousandth number by a special heavy strawboard card, which prevents damage to the ordinary ones. The information for the re-verification of meters within the six-year period is taken from these record cards. For checking this record file, it was decided to have a miniature ledger card written, with the consumer's name and address and the number of the meter in use, and to re-sort these cards numerically to check with the meter record file. For this purpose, cards of 3 in. by 5 in. size were provided in special colours to designate different classes of meters. A yellow card was written for meters in stock, a white card was used for active consumers, and red denoted a locked meter. Active consumers represent the meters on which bills are rendered monthly, as shown by the ledgers; locked meters are those still on the consumers' premises, but with no bill being rendered.

A day for the inventory was fixed, and when all the cards were prepared and filled in with the necessary particulars, actual sorting commenced. A number of wooden compartments were made to fit on the desks, and in these were placed the sorted cards, according to meter size. Then the same compartments were used for numerical sorting. In comparing the meter record card with the inventory card, if found correct, a stamp was placed on both cards. Where the record was found to be different, the cards were returned to the ledger department for re-verification. When all the cards had been verified, attention was given to meters condemned, sold, destroyed by fire, and lost or stolen. In the final analysis there were found quite a few meters on the unaccounted-for list.

Investigation is still being carried on; but now there are not many unaccounted-for. From what has been accomplished so far, it is felt that the time and labour taken in making the inventory has been of inestimable value. It has brought to light errors and discrepancies in the system, the discovery of which will be of lasting benefit.

DAYTON OIL-GAS PROCESS.

Another paper described work done by Messrs. K. G. Hamilton and C. M. Welling, in connection with the Dayton oil-gas process, at Plymouth (Mass.), under the direction of the Chemical Department of the Massachusetts Institute of Technology, combined with published data furnished by the General Oil Gas Corporation. The object of the work was to check the efficiency of the process as claimed by the manufacturers. The plant was described, and then the tests, after which the authors said it is interesting to note that it can be demonstrated, practically and theoretically, that, while it carries a high percentage of inert nitrogen, the flame temperature for Dayton gas within the limits of 350 to 500 B.Th.U. will exceed coal or water gas of the same calorific value, and that the heat available from the same amount of gas of the same B.Th.U. value will be greater, due to a smaller weight of combustion products per unit volume of gas burned, and hence less heat lost to the waste gases.

Tables of Gas Volume Factors.

H.M. Stationery Office have published, in the form of a large, clearly printed card, a table giving the multiples for gas volumes ranging from 40° Fahr. and 28 in. of mercury to 84° Fahr. and 31 in. of mercury. The factors are calculated from the formula $V = \frac{459{\cdot}4 + t}{17\,617\,(h - a)}$, where V is the volume, h the pressure of the gas in inches of mercury, and a the vapour pressure of water at $t°$, the latter being the temperature on the Fahrenheit scale. A companion card shows, in corresponding tabular form, the logarithms of the above-mentioned figures. The price of each card, obtainable from the London office in Kingsway, or from the provincial offices in Manchester, Cardiff, or Edinburgh, is 3d. net.

WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.

Meeting at Swansea.

The Association met at Swansea on the 4th inst., when the first Presidential Address was delivered, and an inspection of the Swansea Gas-Works was included in the programme. After meeting at the works, the party were conducted over the plant, and the various operations were explained.

The visitors proceeded to the retort-house, and inspected the tipping, crushing, and elevating plant, and the method of conveying coal to the overhead bunkers. These overhead bunkers feed by gravity into charging boxes, each of a capacity of 6 cwt.; there being three charging boxes to each bed. The house has an installation of inclined retorts, having regenerative settings fitted with step grates. There are twelve beds of retorts, eight in each bed, and each is fitted with a separate hydraulic main of ⊃ section. Over every six beds there is a tar tower. The coke is discharged by gravity, and either directly fed to the generator or conveyed to overhead storage hoppers outside the retort-house by means of a push-plate conveyor in the first place, and then a gravity bucket conveyor. The carburetted water-gas house contains five Humphreys and Glasgow water-gas sets. An inspection was also made of the new cooker cleaning and repairing shops, and the method of dismantling, vatting, drying, re-assembling, enamelling, polishing, and testing was explained. The new meter stores and testing department were shown, and also the test-holders, &c. An interesting item was the bench for testing consumptions and efficiencies of various gas appliances. The new fittings stores were visited, and the system of store-keeping (card index) explained. The Swansea Gas Light Company have recently installed new compressing plant and 12 in. diameter steel tubes, for the purpose of sending a supply of gas at high pressure, and through a Reynolds diaphragm governor, to an outlying district. The new compressing plant, installed by Messrs. Geo. Waller & Sons, was inspected.

THE ASSOCIATION WELCOMED.

Subsequently the business meeting was held in the Gas Company's offices.

Mr. OCTAVIUS THOMAS (President of the Wales and Monmouthshire District Institution of Gas Engineers and Managers) took the chair at the outset, and said he was very pleased the Association had been started. He was afraid that the war, and the formation of the National Gas Council and the Federation of Gas Employers, had somewhat delayed the commencement of a Junior Association in Wales and Monmouthshire. He appealed to the members to assist in every way they could, in which case much benefit would be derived by all.

Mr. W. H. JOHNS (the Engineer and Manager) then, on behalf of the Chairman and Directors of the Swansea Gas Company, extended a very hearty welcome to those present, and hoped that what they had seen on the works would be of value. He said that when he mentioned the matter to his Directors, they were pleased to hear of the starting of a Junior Association in South Wales. It must be to the advantage of gas undertakings generally for such an Association to be in existence; and they were very fortunate in having so capable a Secretary as Mr. B. J. Bell, of Cardiff, who previously had been actively connected with the Midland Junior Gas Association. He was pleased to see the large number present. There was no reason why the Association should not be as successful as similar organizations which were in operation in different parts. The Directors felt they were specially honoured by the Association's electing a Swansea member as their first President. Speaking personally, he was in daily contact with Mr. Armitage, and was positive they had elected a first-class man.

Mr. T. B. ARMITAGE (Swansea) then took the chair, and proceeded to deliver the following

PRESIDENTIAL ADDRESS.

The choice of a subject upon which to address you has occasioned me careful thought. After consideration, I have decided to deal with a matter which I think has been neglected, and which should be developed to its fullest extent by the gas industry. I refer to the question of water heating—particularly hot-water circulation. Until a few years ago, the question of hot-water supply was left in the hands of the builder, with the result that in most cases the range boiler was recommended, and the advantages of the circulator or geyser not brought forward to the notice of the public as they deserved.

I propose to spend but a very short time with the geyser, as this type of apparatus, when fitted, carries out the whole of the duties of heating and delivering the hot water; and, given an adequate supply of gas and water, few difficulties present themselves. However, there are just a few points worthy of mention. In the first place, when buying, I think it will be agreed that the sealed type of geyser is far superior to the open type, as in the sealed pattern the water does not come in contact with the products of combustion, and leaves the geyser as pure as it enters, and may thus be used for drinking or cooking purposes; whereas in the open type the products of combustion come in direct contact with the water, and so the hot water is unfit for drinking or cooking. Of course, it is quite possible that a consumer will say, "Oh, but the geyser will only be used for the bath; and the price is slightly less, so I see no objection to it." But we are all aware of the temptation, when the maid is a little late in rising, to make the early cup of tea with hot water from the geyser. Therefore, in my opinion, the open type of geyser should not be stocked, as, while there is the slightest chance of a piece of apparatus being put to a use which is detrimental, that apparatus is not good enough for the gas industry. Another point is that the geyser must be foolproof—that is, it must be impossible to turn off the water and leave the gas alight. This is easily overcome by only stocking machines with inter-locking taps or automatic valves. These are, to my mind, two of the chief points to be considered when buying. Personally, I would never stock a geyser of under 2½ gallons capacity, as if anything less is required, it can be obtained by a cheaper machine of an approved make, many of which are on the market—similar to Richmond's "Lyn" boiler, Wright's "Hotwell," &c.

In fixing geysers, it is most important (as with every other class of gas apparatus) to see that gas-supply pipes of large enough dimensions are used, as nothing tends so much to condemn the geyser in the eyes of a consumer as to find that the amount of hot water obtained does not come up to expectations. More complaints as to inefficient geysers are traceable to the small size of the gas-supply pipe than to any other source. Therefore, if we err in this respect, let it be on the right side. Last, but by no means least, in no case must a geyser be fitted without an adequate flue-pipe delivering either into a chimney or to the open air. This is most important, as geysers are usually fixed in small rooms where, if there is no outlet for the products of the burnt gases, accidents are quite possible.

Now we come to the gas-heated circulator, the fixing of which is a much more scientific matter, as, unlike the geyser, it is not a complete hot-water apparatus, but is only a part of a system, the duties of which are to deliver hot water to any part of the building where it is installed. Therefore, it will be understood that, in addition to simply fixing the circulator, other factors have to be taken into consideration, and the whole system of hot-water circulation understood, if we are to get the best possible results. [The President then, by means of a sketch, described an independent installation on the cylinder system.] Proceeding, he said: We are very frequently asked to fix a circulator to work in conjunction with a coal-range boiler, the reason usually being that during the summer months, when the kitchen range is not in use, a supply of hot water may be obtained; or it may be that the coal-range boiler is not giving satisfaction. In the latter case, it is very necessary that the inspector or superintendent makes a careful examination of the whole of the installation, and decides if any alterations are necessary. It is inadvisable to fix a circulator unless the installation is made suitable, as at the present time each failure to give satisfaction does an immeasurable amount of harm; and even if the fault really lies with the installation you will usually find that it is the circulator which gets the blame. If the installation is found correct, to connect-up the circulator to work efficiently in connection with the range boiler is a simple matter, provided ordinary care is exercised. The only difficulty to guard against is inter-circulation—that is, circulating from one boiler to the other instead of to the cylinder. This is easily avoided by using pitcher tees, or tees set at an angle of 45° instead of right-angles, when connecting into circulating pipes of iron or copper, and when in lead joining-up at a similar angle. If these precautions are taken, the circulator will be found to work satisfactorily either independently or together with the range boiler.

Of course, the actual responsibility of the successful working of the circulator devolves upon the person who superintends the fitting-up of the installation, or, in the case of fitting to an existing installation, upon the person who makes the examination. This being so, it will be well if we note a few of the most important points that must be watched:

1.—*The Position of Cylinder and Circulation Pipes.*—The cylinder should be fixed as close to the circulator as it can conveniently be placed, and at about 2 ft. higher level. This is an important point, as the closer to the circulator the cylinder is fixed, the shorter will be the circulating pipes, and the less the loss of heat by radiation as the hot water is conveyed from the circulator to the cylinder. This heat loss is not so small a matter as it may seem, as the average loss is equal to 1 c.ft. of gas per hour for each 10 ft. run of pipe. Therefore it becomes rather a serious amount if the circulating pipes exceed 30 ft., as they do in many places. I would recommend that, where it is impossible to fix the cylinder in close proximity to the boiler, circulating pipes should be wrapped with hair felt, which will prevent a great amount of this loss. Also it is necessary to see that all sharp bends and elbows are avoided in the circulating pipes, and that in the case of lead pipes these are run on boards and well clipped, to prevent their sagging and thus becoming harmful to circulation.

2.—*Cold Supply Pipes.*—It is essential that the cold supply pipe delivers horizontally into the cylinder, and that it is of the same diameter as the exhaust pipe; for on this pipe depends a quick delivery of cold water to the cylinder, which also means a good supply of hot water at the taps.

3.—*Hot Supply Pipes.*—It is also necessary to see that all the hot supplies are taken from the expansion or exhaust pipe, as it is sometimes found that hot supplies have been taken off the flow pipe. In this respect, I may say that we have encountered three such cases during the last eighteen months in Swansea. Needless

to say, the work in question was not executed by the Gas Company's fitters, but has since been rectified by them.

If all these points are carefully observed, there should be no trouble with the water supply. The gas supply hardly calls for attention; but I would recommend the supply to be run direct from the meter, and that nothing less than ¾ in. pipe be used. It is absolutely essential that a reliable thermostat be fitted, to ensure that gas is only consumed when serving the useful purpose of heating the water to the required temperature. It is not too much to say that the successful application of gas to water heating largely depends upon the efficient working of the thermostat. It must be remembered that of a twelve-hour kitchen day, only three or four hours are devoted to water heating. Consequently, the thermostat has to control the gas for about nine hours a day. If, therefore, the thermostat does not ensure a low gas consumption, the loss during the idle hours will be serious.

The cost of gas is no bar to its use for heating water. If a coal-burning range is used for heating water only, it costs more than gas for this duty; and it is only that the range-fire is kept alight for other purposes that allows of its heating the water at a reasonable cost. When gas is used for cooking, then the gas-boiler is a more economical water-heater than the coal-fire, in addition to having the advantages of being cleaner, effecting a saving in labour, and, what is most important, giving more speedy results.

In conclusion, the following calculation may be of some service in demonstrating the cost of heating by gas, taking gas at 450 B.Th.U. as at Swansea: 1 B.Th.U. is the amount of heat required to raise 1 lb. of water 1° Fahr. 1 c.ft. of gas contains 450 B.Th.U. Therefore 1 c.ft. of gas will raise 450 lbs. of water 1° Fahr. As 10 lbs. of water equal 1 gallon, 1 c.ft. of gas will raise the temperature of 45 gallons of water 1° Fahr.; but as hot water is usually required at about 125° Fahr., and normal cold water is about 50° Fahr., we require to raise the temperature 75°, which, working on the same formula, shows that we require 75 c.ft. of gas to raise the temperature of 45 gallons of water from 50° to 125° Fahr. This, with gas at (say) 5s. per 1000 c.ft., equals 4½d. Against this we have loss by radiation, &c.; but if we add one-third, and say 6d., I think it will be agreed that water heating by gas is an economical proposition.

The HON. SECRETARY (Mr. B. J. Bell) said it was his pleasing duty to propose a hearty vote of thanks to the President for his practical address. The subject dealt with was one which they would find, as time went on, would become more and more important to the gas industry. Gas engineers and manufacturers must look upon the distribution side to dispose of their product; and it was necessary that they should know absolutely the limit to which they could advise consumers to use gas. The President had shown that water-heating was cheap when using gas as an agent; but it was essential that they should clearly understand the conditions which governed the supply of hot water and the gas consumption, and the means of adjusting the latter. Though the President had not mentioned it, it could be assumed that there was a wide field apart from water heating in the use of circulators.

Mr. T. A. CANNING (Newport), one of the Vice-Presidents of the Association, in seconding the vote, said he thought the choice of first President had been a very wise one. Mr. Armitage was an able man, and had struck the right note.

Mr. V. DODGSON (Pontypridd) supported the resolution, and remarked that they were looking to gas heating for future sales development.

Mr. JOHNS, Mr. CLARK JACKSON (Neath), Mr. E. ABLETT (Swansea), and Mr. J. MOGFORD (Briton Ferry) all congratulated the Association on its magnificent start, and expressed their pleasure that such an organization had been formed.

Following the meeting, the members made their way to the Mackworth Hotel, where they were entertained at tea by the Directors of the Gas Company, who were heartily thanked for their hospitality.

WATER POWER IN THE BRITISH EMPIRE.*

EVERYONE interested in any way in the supply of energy for power purposes should be anxious to learn all about the rival sources of power—their scope and potential positions. The book before us gives in small compass a vast amount of information as to power requirements; and the position that water power in the British Empire holds in respect of capacity for serving those needs. The volume mainly consists of information contained in the reports of the Water-Power Committee of the Conjoint Board of Scientific Societies; and this information is here presented in condensed, handy, and readable form under the editorship of the Secretary to the Committee, Prof. A. H. Gibson, D.Sc., M.Inst.E.E. The Committee were appointed in 1917; and the members pursued their inquiries until the issue of the third and final report in January, 1921. To study the full text of the reports would be vastly time-absorbing; but here we have the salient features in a highly valuable form. Furthermore, some of the figures in the earlier reports were defective in certain respects; and they have been rectified in this book.

An extremely interesting part of it, because of its concentrated informative character, is the preface by Sir Dugald Clerk. In this, he almost tries to make us imagine what an oil-less and coal-less world would be like, or will be like when these sources of energy have been exhausted. We will not overtax our minds by trying to fashion the distress of the world and its industrial sterilization when those far-off conditions come about. But there is no doubt, as Sir Dugald says, that, as time goes on, hydraulic power must become of increasing importance. We shall, in an enlarged measure as coal becomes scarcer, and therefore more expensive, have to look to water power as a substitute for coal power, in its many forms of reciprocating steam-engines, steam-turbines, and coal-gas, blast-furnace gas, and producer-gas engines.

There do not seem to be any authoritative figures regarding the power requirements of Great Britain and Ireland of later date than 1907; and therefore we have no doubt that in normal times the power of industrial engines given by Sir Dugald in the preface, from the census of production of fifteen years or so ago, would require considerable additions made to them. The war, for instance, probably caused an inflation of power machinery. However, though somewhat old, the figures still have interest. Here they are:

The total power of industrial engines in use in Great Britain and Ireland is given as 10,578,475 H.P., and the steam-engine power of road rollers and road locomotives owned by public authorities amounted to 167,192 H.P. Of the industrial engines, steam reciprocating engines were rated at 9,118,818 H.P.; steam-turbines, 530,892; internal-combustion engines, gas, oil, &c., 680,177 H.P.; and water-power, 177,907 H.P. The persons employed in the factories using this large power numbered nearly 10½ millions; so that, roughly, the power available for the industries of Britain was nearly 1 H.P. per person employed. To support the 46 millions of people now living in the United Kingdom, thus requires a continuous enormous expenditure of power, and a very large consumption of fuel.

It should be explained that the Committee formed in November, 1917, by the Conjoint Board of Scientific Societies to collect data and report as to the water-power position, was followed by a Board of Trade Committee. Of the former Sir Dugald was Chairman, and of the latter a member. He has therefore had special facilities for studying this matter, and is now able to give an outline of the present water-power position. He does so as follows:

Taking the United Kingdom first, there appears to be a total of 1,350,000 H.P. available continuously throughout the twenty-four hours; and if any great tidal scheme be included, such as that of the Severn recently widely discussed, another 400,000 continuous horse power must be added, giving a total of 1,750,000 continuous horse power, divided as follows:

	Horse Power.
England and Wales	450,000 per 24 hours
Scotland	400,000 ,,
Ireland	500,000 ,,
Tidal schemes (Severn)	400,000 ,,
	1,750,000 H.P. continuous.

This total could be obtained if required, but at a cost higher than appears necessary at present. In Scotland, however, an additional power of 183,000 H.P. continuous is immediately feasible, as is shown by the expert examination of nine schemes having average outputs ranging from 7000 to 40,000 continuous twenty-four hours' horse power. These schemes could be developed at a cost appreciably less than from coal-fired stations built and operated under existing conditions. In England and Wales the cost of development is greater; but a large proportion of the total is quite commercial. In Ireland the position appears to be highly favourable; and it is considered that the whole industrial power required for that country could be supplied seven times over. Ireland could be run for motive power and railways by hydraulic power alone, and coal and other fuel consumption could be entirely dispensed with for power purposes. The 10 million horse power of heat engines could not be entirely supplied by water power; but very substantial fuel savings could be made by a much extended use of water.

The total available horse power in Great Britain and Ireland appears to be insignificant when placed in contrast with that of some other countries; but when we come to consider the British Empire in the whole, the aggregate hydraulic power approaches 70 million continuous horse power, which, as Sir Dugald says, is "a truly remarkable power, to be used in the present to a small extent, and in the future to a very large extent as our coal resources become reduced."

This may appear to be a review of what Sir Dugald says rather than of what forms the bulk of the contents of the book; but this covers a vast area within the 54 pages, which are packed with eye-opening information. We heartily recommend the volume to all engineers.

Ramsay Memorial Tablet.—The name of Sir William Ramsay has been honoured by the erection of a tablet in Westminster Abbey which was unveiled on the 3rd inst. by H.R.H. the Duke of York. The unveiling was attended by a large number of the brilliant investigator's friends, and after the ceremony His Royal Highness was presented by His Excellency the French Ambassador with the Ramsay Memorial Gold Medal.

* "Water Power in the British Empire: The Reports of the Water-Power Committee of the Conjoint Board of Scientific Societies." Edited by Prof. A. H. GIBSON, D.Sc., M.Inst.C.E., with a preface by Sir DUGALD CLERK, K.B.E., F.R.S. Price 3s. 6d. net. LONDON: Constable & Co., Ltd.

GAS SALESMEN'S CONFERENCES.

Association of Gas Salesmen (Northern Area).

Since the opening meeting of the Salesmen's Conference for the Northern Area, which was held at Darlington, much good foundation work has been accomplished by the Committee who were then appointed. The organization will now be known as the Association of Gas Salesmen (Northern Area); and the aim is to develop in each salesman the positive knowing and will powers of the mind, the building-up of the man, and an increased knowledge of the goods and the customer, in order that these qualities may be reflected in his business.

It was arranged that conferences should be held on the first Wednesdays in March, April, September, and December; but owing to the close proximity to the opening meeting, the September conference had to be abandoned. By invitation of the York Gas Company, it has been arranged to hold the next conference at York on Wednesday, Dec. 6, when the Chairman (Mr. A. B. Roxburgh) will deliver an address dealing with "The Character of the Individual as Applied to Salesmanship." There will be a paper by Mr. Frederick Milner, of Scarborough, on "How to Organize a Water-Heating Campaign: What to Recommend, and Why I Recommend It;" and a general discussion will be opened by Mr. George Perkins, of Hull, on "Points I am Guided by when Purchasing Gas Apparatus for Sale or Hire."

South Wales and Monmouthshire Section.

The second meeting of Gas Salesmen of South Wales and Monmouthshire was held at the offices of the Newport (Mon.) Gas Company, by permission of the Directors, on Thursday, Oct. 26. Mr. J. H. Canning, the Company's Engineer and Manager (who took the chair in the absence through indisposition of Mr. Steele, of the Rhymney and Aber Valleys Gas Company), extended a cordial welcome, on behalf of the Directors, to those who had gathered together. He wished the salesmen of South Wales every success in their endeavours to stimulate business for the undertakings represented, and believed that much benefit would be derived from the meetings that were being held for the purpose of promoting sales.

The subject which had been arranged for discussion was "The Aims and Objects of Salesmen's Meetings, and the Best Way of Attaining them." Mr. B. J. Bell, of Cardiff (Secretary to the Meetings), opened the proceedings by giving a general outline of the subject in hand, and then dealing with the many points appertaining to the business of a salesman. Acknowledgment was made of the past activities of the gas industry, which had brought concerns to their present stage of success; and the necessity of surveying existing conditions to build-up a well-considered scheme was mentioned. The aim of salesmen's meetings, he said, is to co-ordinate ideas, and, by discussion of problems as they arise, to promote that thorough understanding which alone ensures effective endeavour. They had behind them progressive concerns which had offered every encouragement for development, and also the support of the British Commercial Gas Association, which had been responsible for the inauguration of the scheme. Mr. Bell went on to deal with the questions of maintenance, adequate supply pipes, and effective methods of advertising. The therm was also referred to, as there had been little attempt to "think in therms." In pooling experience and ideas, he concluded, schemes will be formulated with definite proposals for the assistance of salesmanship, and ultimately result in valuable effort satisfactory to all concerned.

A report of Mr. Bell's remarks, and those of subsequent speakers, will appear in the next issue of the "Gas Salesman."

After the meeting tea was provided by the Company, and then the Council of the Salesmen's Meetings met to discuss future arrangements.

Verticals and Down-Flow of Gas.

Mr. A. F. Kersting, of Jackson (Tenn.), ventures to make a prophecy, based on extended small-scale tests, that some future continuous vertical retorts will take all gas off at the bottom of the retort above the steaming coke boot. Then all the coal gas will descend through the progressing coking stages and attain uniform constructive fixation, producing practically no tars, and avoiding lampblack by proper speed of coke extraction. This bench, he says, should be applicable to the 10-ton plant, wherein expensive mechanical control is displaced at low manual cost by frequent partial extraction and feed. This scheme of parallel flow of gas and coking mass, he says, does not appear to be patentable; but his small-scale retort gave a yield of 7 c.ft. of 700 B.Th.U. gas per pound of fuel. He remarks that, while the larger plants can develop residual sales in coke and rich tars from up-flow continuous verticals, it would be a boon to some of the smaller plants to have chiefly gas at cheap cost to sell. It is his hope that this down-flow suggestion may be tried for practical results in connection with some existing vertical plant.

Midland Junior Gas Association.—There is to be a meeting of the Association in the Council House, Birmingham, on Thursday, Nov. 16, at which Mr. G. M. Lewis, Showroom Manager to the City of Birmingham Gas Department, will read a paper on "Showroom and Service."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Expenses of Members of Junior Associations.

SIR,—I have been particularly interested in reading this week's Editorial Notes in the "JOURNAL," but unfortunately find that a portion of the information therein contained is not quite correct; and I should esteem it a favour if same could be rectified.

My Directors unanimously agreed to pay in full the travelling expenses of members of our staff attending the meetings of the Yorkshire Junior Gas Associations; and as our output is approximately 150 million c.ft. per annum, and as we have four of our staff members of the Association, you will readily agree that we compare very favourably in this respect with any large undertaking in the county. Further, so interested are my Directors in the education question, that they unanimously approved of my suggestion to refund entrance fees and travelling expenses of any of our employees attending classes in Gas Engineering, Gas Supply, or Gas Fitting, subject to 75 p.ct. attendances being made at the classes.

J. BRIDGE,
Engineer and General Manager.

Elland-cum-Greetland Gas Company, Nov. 10, 1922.

SIR,—In perusing Mr. Shapley's paper to the Yorkshire Junior Gas Association, as reported in the "JOURNAL" of the 1st inst., I note from the discussion that ensued, and from your editorial notes on the 8th inst., that it was stated that this Company paid only half expenses to the juniors attending these meetings.

I shall be glad if you will kindly correct this statement, as it is our practice to pay full expenses, with a view to encouraging our officials as far as possible in their studies and in the work of the Association.

R. HALKETT,
General Manager.

Sheffield Gas Company, Nov. 13, 1922.

Do We Know Where We Are?

SIR,—In spite of counter-attractions, I read with great interest your leader in the "JOURNAL" for Oct. 11 on "Favoured Declarations in Existing Circumstances," and was interested to find that Mr. Sumner advocates 400 B.Th.U. gas. It is only fair to presume that this is the logical result of going to law to claim a 425 B.Th.U. gas. However, being an inventor, I am accustomed to meeting with occasional reverses, which I regard as milestones in the path of progress. In confidence I may tell you that I am accustomed to receiving "more kicks than ha'pence." But, to return to my old love the gas industry, you have been one of my supporters in my efforts not only to improve the position of the gas-works, but to study the interests of their consumers.

There appears to be something in low-grade gas after all; and I claim that the national interests demand a more thorough investigation and application than has yet been undertaken. You can take it from me that the ice is broken, and that the consumer is beginning to appreciate more and more the advantages of gas in his home—especially when it is efficiently supplied. This entails that it should be efficiently produced at the works and efficiently used in the appliances supplied to the consumer. I do not believe in supplying inerts in gas, and I am glad that this practice is falling into desuetude.

What the country wants is the maximum possible therms from the coal at the lowest possible price. A therm in the gas should cost no more than a therm in the coke; and as this would make the cost of coke prohibitive at the present price of gas, I say, "Let us have all gas and cheaper gas for everyone, including the gas-works." A 400 B.Th.U. gas has an increasing number of adherents; and I am demonstrating that a 350 B.Th.U. gas low in inerts is perfectly satisfactory from a town gas point of view.

C. B. TULLY.

47, *Victoria Street, S.W., Nov. 8, 1922.*

REGISTER OF PATENTS.

Improvements in the Coking of Coal.—No. 186,384.

ILLINGWORTH, S. R., of Radyr.

No. 14,676; May 26, 1921.

(Patent of Addition to No. 164,104 of Feb. 28, 1920.)

This invention relates to modifications of the invention described in specification No. 164,104* relating to the coking of coal; and the objects of that and of the present inventions are to obtain a dense coke produced under uniform conditions, the production of coke from coals from which under present conditions it is not possible to obtain such coke, and to improve the yield and quality of the bye-products.

According to the former specification, these results were obtained by preheating the coal to a temperature below 500° C.—that is, to a temperature at which all resinic substances in the coal are decomposed. The process, however, may be carried out at temperatures above 500° C. but below 600° C., at which temperature decomposition of the products that it is desired to eliminate from the coal takes place more rapidly, the yield of bye-products will be smaller, and, moreover, benzenoid hydrocarbons are produced. The higher the temperature employed, the greater the decomposition of the hydrocarbons first evolved; the amount of decomposition depending on the time the hydrocarbons are in contact with the hot walls and fittings.

* See "JOURNAL," July 13, 1921, p. 106.

It is known that a certain minimum temperature for the preheating must be employed for each type of coal; and this minimum temperature is higher the greater the carbon-hydrogen ratio of the coal. The desired degree of preheating can be achieved by the employment of any temperature above the minimum up to 600° C.; and since the rate of decomposition of the substances that it is desired to eliminate increases with rise of temperature, the period of preheating is thereby shortened.

According to this invention, coal is submitted to a preheating temperature between 500° and 600° C. out of contact with air, so as to destroy the non-coke-producing substances, but leave in the product resinic substances of a weight not less than 5 p.ct. of that of the product. Also, the process described in specification No. 164,104 and the process above described may be conducted in a vacuum produced by a gas-pump or the like. The use of a vacuum is particularly advantageous when the higher temperatures are employed; the hydrocarbons being more readily disengaged from the charge and the time of contact with the hot walls and fittings being shortened, and therefore the decomposition of the hydrocarbons first given off being lessened. The degree of vacuum would depend upon circumstances; but at temperatures over 450° C. a vacuum of at least 20 in. of mercury would be used, and at temperatures above 600° C. endeavours would be made to attain 28 in.

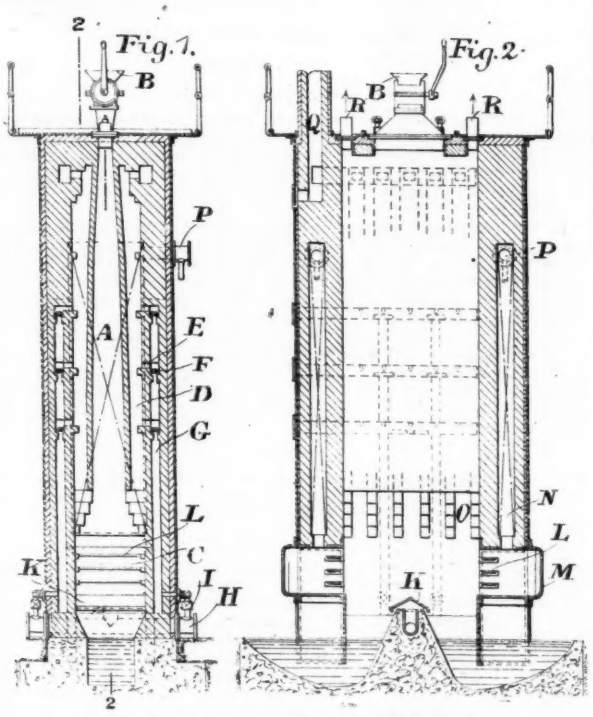
Total Gasification of Fuel.—No. 186,742.

WOODALL, DUCKHAM, AND JONES (1920), LTD., DUCKHAM, Sir A. M'D., and KENT, A. T., all of Grosvenor Gardens, S.W. 1.

No. 19,537; July 20, 1921.

This invention relates to an improved method of operating the generator, in apparatus for the complete gasification of fuel, of the kind in which the fuel passes intermittently or continuously by gravity through a retort terminating at its lower end in a generator, and to the construction of apparatus suitable for the method.

According to the invention the air blast for the blow is introduced vertically upwards along the middle line of a mass of fuel having a horizontal cross section considerably longer than it is wide; and the steam blast for the run is introduced horizontally at the end or ends of the cross section, being preferably reversed at each run or during each run. In this manner an even consumption of fuel is attained with consequent regular feed of the fuel through the retort; and other advantages are claimed which will be understood from the following description.



The Duckham-Kent Total Gasification Plant.

Fig. 1 is a diagrammatic vertical section through a combined retort and generator constructed according to the invention; and fig. 2 is a section on the line 2—2 of fig. 1. The retort A is of known form, and is fed periodically from the hopper B. It is heated by combustion of the producer gas made in the generator C; this gas being burnt in the flues D by secondary air admitted at the required levels from flues A through ports E under control of dampers F. The secondary air is supplied under pressure from the primary-air main H through valves I. The primary air main extends through the middle of the generator, transversely thereto and below the grate. The delivery of the primary air is, however, above the grate, beneath a distributing hood K, which extends across the generator. The ends of the generator are constructed as grates; the bars L being broad enough to support the fuel at its angle of repose. These grates are covered by doors M; and the chamber formed between each door and the corresponding grate is in communication with a flue N in the retort setting, which flue is packed with chequer brickwork or the like.

In operating the generator, the products of the "blow" pass up the passages O into the flues D, where they are burnt as aforesaid. When the blow has been continued for a short time, air is cut off from the main H and steam is blown in at the top of a flue N, which it descends to enter the generator between the bars L. The bulk of the water gas thus generated passes away through the bars at the opposite end of the generator into the other flue N, which it ascends—imparting heat to the chequer work, and finally passing to the main by pipe P. At the end of this run follows another blow, after which the steam is introduced down the flue N which has just been heated by the water gas; and the water gas now produced ascends the flue at the opposite end of the setting. The waste gases from the flues D escape by a chimney Q, and the distillation products are withdrawn from the retort through pipes R. Some of the water gas is caused to pass up the retort.

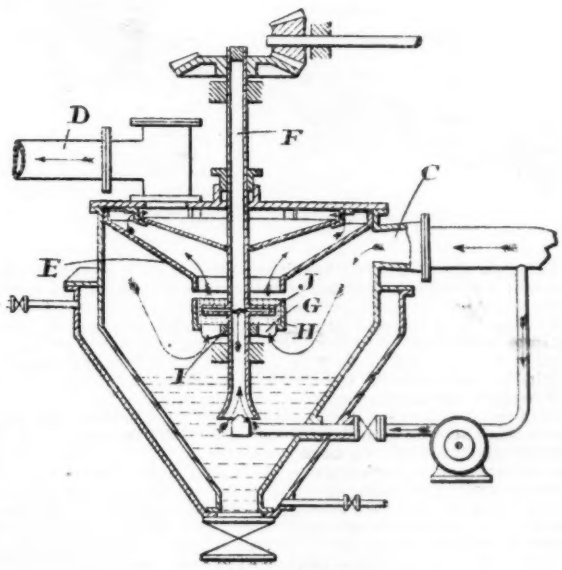
Treatment of Gases, Oil Vapours, or Gaseous Mixtures.—No. 186,945.

WARD, J. F., of Elgin Cresent, W. 11, NIELSEN, H., of Muswell Hill, N. 10, and LAING, B., of Hatfield.

No. 9653; March 31, 1921.

This invention relates to methods of treating gases or vapours of the kind in which a liquid medium is employed, which may contain a catalytic solid in suspension, and in which the gas to be treated is admitted to an apparatus containing the liquid medium and is brought into intimate contact therewith by centrifugal or cyclonic action in order to cause the liquid or the solid contained therein to absorb one or more constituents of the gases, or else to promote a reaction between the gases and the liquid or with the solids contained therein; the liquid medium in the latter case acting as a carrier for the solid medium. The apparatus is applicable, for instance, to the absorption of sulphur compounds in the hot state from gases obtained by any well-known process of carbonizing or gasifying carbonaceous materials

According to another feature of the present invention, the desulphurization and hydrogenation and/or oxidation of gases or oil vapours is carried on simultaneously by means of catalyzers and/or oxidizing agents (which are suspended in the liquid or liquids in an extremely fine or colloidal state) in the presence of ammonia, whereby the agents are utilized to their fullest extent. If the oil vapours are of the unsaturated kind, such as are generally obtained by any well-known carbonizing process, it has been found that the addition of ammonia vapours is highly beneficial for the production of a saturated vapour; while, in addition, the desulphurization process is greatly facilitated by the presence of ammonia either in the gaseous, liquid, or solution form. The same result may be obtained by utilizing a gas, preferably producer gas, such as is obtained from carbonaceous materials gasified under bye-product conditions, which contains a certain percentage of ammonia derived from the fixed nitrogen originally contained in the carbonaceous material. The centrifugal or cyclonic apparatus, which is the subject of the invention, may be constructed in such a manner that the desired reaction can take place above or below atmospheric pressure.



A Cyclone Scrubber.

We reproduce here a part-sectional elevation of one form of cyclone apparatus according to the invention; the inlet being relatively displaced for convenience. In operation, the gases or vapours to be treated enter the apparatus at great speed through the tangential opening C; and by reason of their velocity and the centrifugal force thus obtained, they travel spirally round and close to the inner surface of the apparatus, which is partly surrounded by an attemperating jacket. As fresh gases enter, the gases are forced to assume a downward motion towards the centre of the apparatus, where the rapidly revolving vanes or propellers G suck or propel the gases vertically upwards through the rotating basket or mixing chamber H, and eventually force them through the central opening of the baffle plate E. At the same time the liquid with the suspended matter contained therein is forced upwards through the tube F by the injector action of the

compressed gas or gases, and discharged through the openings I and radial tubes J into the interior of the basket H; being thereby sprayed or atomized, and sent with great force through the rapidly whirling vapours, and thence through the perforations in the basket H. After treatment the gases pass to the outlet D; while the liquid with the suspended solids eventually finds its way to the lower part of the apparatus, whence it is again forced upwards through the hollow shaft J. This process is continued until the desired reaction is completed.

The gas for the injector M may be tapped from the main supply (as illustrated); or in cases where a reaction is desired between two or more gases, the injector receives one of them from a separate supply, the connection between the main and the injector being broken. This would apply in the case of ammonia for preparing saturated oil vapours.

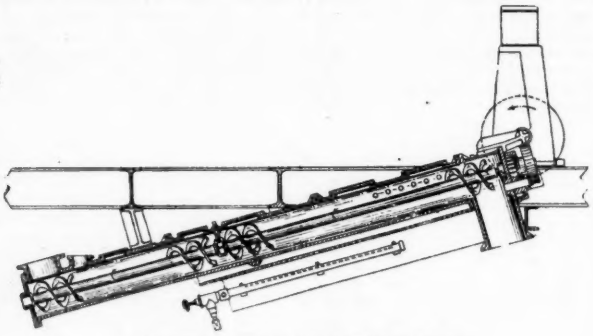
Manufacture of Sulphate of Ammonia.—No. 187,035.

HOLMES AND CO., LTD., of Huddersfield, ADAM, W. G., of Beckton, and COOPER, C., of Huddersfield.

No. 19,217; July 16, 1921.

This invention has for its object to provide an improved method of, and apparatus for, the production of dry neutral sulphate of ammonia. It claims to constitute an improvement in the process set forth in patent No. 108,098,* and essentially comprises a method of manufacture and apparatus therefor in which the crude damp and acid salt, as normally produced from the ordinary manufacturing processes, is passed by mechanical means through a chamber or casing, and at the same time is treated with a current of ammonia gas and heated air which is passed through the chamber in the reverse direction, so that a dry and neutral product is rapidly obtained in one operation.

The ammonia gas for the process may be produced in any preferred manner; and the supply of heated air may conveniently be produced by causing the air to pass through a heated jacket partially or wholly surrounding the chamber through which the salt passes. The air may be forced into the chamber under pressure, or may be drawn through the chamber with the ammonia gas by creating a suction in the outlet pipe by means of a fan, or by a steam or air ejector. In some cases the products of combustion from the heating source (which may be a bunsen burner) are allowed to pass into the chamber together with the heated air, provided that the temperature in the chamber is kept low enough to prevent decomposition of the salt. The excess ammonia from the chamber and certain impurities (such as pyridine) which may be carried off by the air current are separated out from the air by treatment with an acid liquid in known forms of plant. The liquid for this purpose may be the sulphuric acid used in the process of manufacture, or acid mother liquors from the process, or mixtures of either or both of these with water.



Holmes and Co.'s New Sulphate Plant.

The apparatus for treating the salt may be arranged in any convenient manner; and we reproduce one preferred form thereof, shown in sectional elevation. It comprises a chamber of rectangular cross-section and inclined at an angle of (say) 15°, the chamber being carried upon a suitable framework of girders. An opening of substantial size is provided at the lower end, into which the crude salt is fed; and a second opening is provided at the upper end from which the finished product is discharged into a container, or is led direct to a grinder.

Twin spiral conveyors are mounted within the chamber; the conveyors being parallel to each other and of such diameter as to occupy substantially the whole of the cross-section of the chamber. They are also arranged to overlap each other slightly with respect to their circles of revolution, and are geared together by means of spur gearing in such a manner that they rotate at the same speed and in the same direction, so that they do not interfere with each other. The twin conveyors, by the scraping action of one on the other, prevent clogging of the salt, and ensure its being thoroughly agitated and exposed to the heated air and ammonia gas. The conveyors are driven by a prime mover through a worm and worm-wheel keyed upon the shaft of one conveyor.

Partially surrounding the upper portion of the chamber is a casing of thin sheet metal, which is externally heated by a gas-burner fitted with a valve by which the temperature may be controlled. Air is drawn through the casing, in which it is heated, and passes into the chamber through the small apertures shown. The products of combustion from the burner may also in some cases pass into the casing, and thence into the chamber together with the heated air. Ammonia gas is led in through a pipe to the upper surface of the chamber and near its top, and is drawn out together with the heated air through an aperture connected to a suitable collecting pipe in which a reduced pressure is created by a fan, ejector, or other means.

* See "JOURNAL," Vol. CXXXIX., p. 381.

Charging Means for Retorts, Producers, &c. No. 186,834.

MERZ AND M'LELLAN, of Victoria Street, S.W. 1, WEEKS, E. G., of Monkseaton, and STATTERS, A. W., of Newcastle-on-Tyne.

No. 26,542; Oct. 7, 1921.

This invention relates to charging means for retorts, gas-producers, and like apparatus. One object is to provide charging means which will ensure more even distribution of the material being fed than has been possible with hitherto known devices. A further object is to afford simple means for indicating the upper surface level of the material in the retort, and also for indicating variations throughout that surface.

It is claimed to accomplish this by the combination of a distributing device (such as a hopper, chute, funnel, or the like) mounted with its discharge end within the retort above what is intended to be the surface level of the bed of material therein, and means to move the delivery end of the distributer bodily over the surface of the bed—for example, in a circular path about the axis of the retort. Preferably, the delivery end of the distributer is so constructed that it can trail on the surface of the bed and is free to move vertically in accordance with variations in the depth of the bed. Thus the material is delivered on to the bed of the retort in a uniform layer, and the creation of dust by the fall of the material is avoided.

There may also be provided a member (such as a rod) guided for vertical movement, and having one end operatively connected to the delivery end of the distributer and the other end extending to a point outside the retort, where it forms an element of a visual indicator—for example, by co-operating with a fixed scale or equivalent reference. By this means an indication of the upper surface level of the bed of the material in the retort is given.

Conveniently, the material to be treated is delivered continuously to the receiving end of the distributer by means of a conveyor device such as a worm; and it is claimed to be a feature of the invention that the conveyor casing makes a gas-tight connection with the retort through a liquid seal. The object of this is to allow of the free expansion of the retort under heat without imposing any stress upon the conveyor casing.

A clutch is provided in the chute driving gear so that rotation may be stopped independently of the conveyor feed. Thus it is possible to arrest the chute over any part of the fuel bed where a depression exists, as indicated by the scale and rod.

Gas Economizers.—No. 187,053.

HARDIE, A., of Cults.

No. 20,255; July 28, 1921.

This invention relates to gas economizers or gas pressure regulators of the type comprising a casing having a flexible diaphragm forming one wall of a gas chamber, the outlet being controlled by a loaded valve connected to the diaphragm. According to the present invention the valve is of the piston type, and works in a cylindrical ported tube or socket forming the outlet.

In the preferred construction, the apparatus comprises a lower metal part or shallow bowl having inlet and outlet connections for the passage of the gas. This part is enclosed to form the gas chamber by an upper leather or like diaphragm of slightly larger diameter. The diaphragm is weighted by means of a lead washer, a superimposed gas-tight washer, and a nut threaded upon a central vertical spindle which passes through the diaphragm into the socket fixed centrally in the lower metal part; the tube being at its lower end fixed to the bowl part. The working of the spindle within the tube is controlled by means of a spiral spring surrounding the spindle under compression between a piston valve on one end of the spindle and a collar at the upper end of the tube.

Gasification of Coal.—No. 187,076.

FOSTER, A. S., of Stourport.

No. 21,597; Aug. 15, 1921.

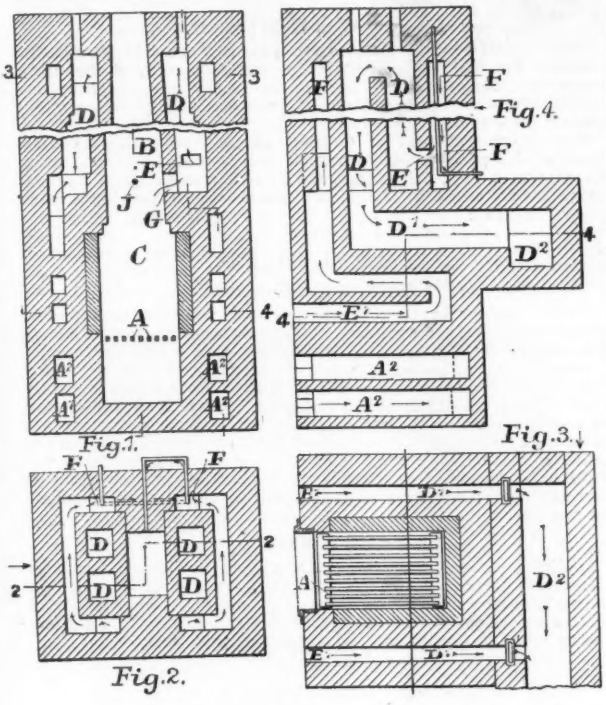
This invention relates to the gasification of coal and other carbonaceous materials of the kind in which the destructive distillation of the fuel is effected at an upper part of the apparatus by the aid of external heat, and the coke or residue is utilized for the production of water gas and producer gas, all or part of which is employed for heating the upper part or retort where the distillation takes place. It is an object of the invention to provide a simple continuously working plant effecting complete gasification of the fuel, and requiring only the minimum of labour for its successful operation.

With this object in view, the patentee provides a construction in which the greatest heat is assured at the bottom of the retort (where the bulk of the water gas is made) just above the off-take for the gas for heating the retort, so as to counteract the effect of steaming and enable the continuous working to be effected. For this purpose the air, which is to complete the combustion of the gas taken off for heating the retort, is introduced near the bottom of the retort adjacent this point, and is preheated by suitable heat interchangers, or regenerators in conjunction with the waste-gas flue. A steam superheater and distributor is provided in conjunction with, or adjacent to, the grate of the producer, arranged so that the back and front, or the two sides, may be steamed alternately. Thus, while one side of the generator is being steamed for the production of water gas, the other is receiving air blast only and is building up a temperature ready for steaming.

Fig. 1 is a vertical section on line 2—2 of fig. 2. Fig. 2 is a horizontal section on line 3—3 of fig. 1. Fig. 3 at the left-hand side is a section on line 4—4 of fig. 1, and at the right a section on line 4—4 of fig. 4; and fig. 4 is a vertical section of the right-hand side of fig. 1.

In the illustrated apparatus primary air and steam are introduced to the fuel on a grate A at the bottom of a vertical retort chamber; and

the upper part B of this chamber is also externally heated by adjacent up and down flues D, into which a part or the whole of the gas from the lower part C—*i.e.*, the producer or generator—is drawn at G, and burnt by the admission of secondary air at E. The burnt gas passes out at D_1 to the waste-gas flue D_2. The air for the combustion of the gas in the flues D is admitted at E_1, and is preheated by any suitable arrangement of regenerator flues as, for example, by up and down passages F, adjacent to the up and down flues D for the burnt gas, and is introduced at the bottom of the up-flue D for the gas at each side at



Foster's Gasification Plant.

E, closely adjacent to the points where the gas is taken off by passage G from the producer. The air-flues F at each side of the retort are connected at the top by side passages (see fig. 2).

The externally heated part B of the retort is charged as required; and if coal is used as fuel, the hydrocarbons are distilled off and the coke or residue feeds down the retort, and makes-up the fuel on the grate A. The primary air to the grate admitted at A_1 is preferably preheated, as for example by passing through side passages A_2 adjacent the lower part of the producer, or by passages adjacent to the chimney flues D_2. The steam is strongly superheated in any suitable manner, and is kept from direct contact with the air blast.

The steam may be first superheated by taking it, by means of thick steam tubing, through the back flues F of the secondary air regenerators. This steam tubing, if desired, can be so arranged by suitable bending and jointing as to be renewed in the minimum of time when necessary, and can be easily fitted even on the smallest of works. The steam is finally led into the bottom of the retort at J for increasing the make of water gas. Steam is also conveyed by means of heavily lagged pipes to superheater chambers—one fixed at the front end and one at the back end of the generator grate A. By means of a suitable cock, the steam is switched to either superheater as required; this operation being carried out automatically by any suitable mechanical, electrical, or hydraulic arrangement. The patentee describes, in this connection, a tipping pan operated by water run alternately into one of two compartments; movement occurring when a certain level is reached, and the water then draining out while the other compartment fills-up and eventually reverses the procedure.

The steam issues from each superheater by a series of holes suitably protected, to prevent coke or clinker from choking them. The superheaters act as spreaders, and deflect the steam into the side of the generator required; and while one side of the generator is being steamed, the other is receiving air blast only and building-up temperature ready for steaming. The superheaters are preferably constructed as bearers for the fire-bars of the grate, by providing them with notches in the upper part and with brackets continuing from the seats.

The generator part of the plant is so designed that the lining can be easily removed at intervals; this having most wear and tear. For this purpose the lining is preferably of silica or other suitable refractory blocks, not bonded with the surrounding brickwork. The plant is capable of being run on coal, coke, or a mixture of the two. When run on coal, it will make a mixed gas such as coal gas, or coal gas and water gas, with in some cases a proportion of producer gas.

The outlets G from the lower or generator part C of the plant, through which part of the gas is drawn for combustion in the external heating flue D, are at the side of the generator toward the back. At this point the gas will be mostly producer gas when the front superheater is delivering steam, and a mixture of producer gas and water gas when the back superheater is delivering steam; so that it is mainly the gas with the largest proportion of inert gas—viz., producer gas—which is drawn off for the external heating of the retort. Thus the gas rising from the generator through the retort to mix with the coal gas and water gas from the upper part of the retort is mainly water gas.

The plant is admirably suited, says the patentee, for small sized gas-works, as the labour required can be arranged to fit in with the work usually performed by a stoker in such works.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 1.]

Nos. 28,716 to 29,540.

BAKER, B. H.—"Regenerative furnaces." No. 29,409.
BARRACLOUGH, A.—"Gas-cookers and hotplates." No. 29,504.
BRENTFORD GAS COMPANY.—"Plate-racks of gas-cookers." No. 29,116.
CHEMICAL ENGINEERING AND WILTON'S PATENT FURNACE COMPANY, LTD.—"Distillation of tar." No. 29,110.
COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ.—"Apparatus for distributing and measuring liquids." No. 29,231.
GAS LIGHT AND COKE COMPANY.—"Atmospheric gas-burners for cooking-stoves, &c." No. 28,796.
GAS LIGHT AND COKE COMPANY.—"Chimney and ventilating-shaft tops, &c." No. 28,797
GLOVER, W. R., AND GLOVER & CO., LTD., T.—"Apparatus for testing capacity of diaphragms, &c., of gas-meters." No. 29,214.
HARDIE, A.—"Gas pressure-regulators." No. 29,186.
HUMPHREY, G. R & W., AND HUMPHREY & CO., W.—"Boilers for pitch, tar &c." No. 28,745.
JOHNSTON, A. A.—See Brentford Gas Company. No. 29,116.
KEEN, M. F.—"Domestic apparatus for manufacture of coal gas." No. 28 923.
KIRKE. P. ST. G.—"Water-gas plants." No. 29,068
KNIGHT, J —"Protector and smoke consumer for incandescent gas-mantles." No. 29 286.
LARKIN, F. S.—See Gas Light and Coke Company. No. 28,796.
LILLEY, J. H.—"Portable gas-fire, &c." No. 29,315.
LUCAS, G. J. E.—"Metal holder for small incandescent gas-mantle." No. 29,503.
MELLISH, H. S —See Lilley, J. H. No. 29,315.
MEWES, E.—"Inverted incandescent gas-burner." No. 28 864.
ODDY, T.—"Distillation of coal, peat, wood, &c." No. 29 469.
QUAIN, J. R.—"Gas-fired heating apparatus." No. 29,187.
SHADBOLT, S. M.—"Distillation of tar." No. 29 110.
SHAW, A. G.—"Central feed and fixing diaphragm for gas-meters." No. 29,444.
SIMPSON, S.—"Gas-meters." No. 28,934.
SOUTHGATE, F.—"Apparatus for distillation and testing of carbonaceous matter." No. 28,768.
STANTON IRONWORKS COMPANY, LTD.—"Pipes and conduits." No. 28,944.
SUMNER, A. W.—"Manufacture of gas." No. 29,368.
TRADERS AGENCY AND TRUST COMPANY, LTD.—See Hardie, A. No. 29,186.
WHITE, W. C.—"Low-temperature carbonization of carbonaceous material, &c." No. 29,241.
WILSON, P. H.—See Stanton Ironworks Company Ltd. No. 28,944.

[Extracted from the "Official Journal" for Nov. 8.]

Nos. 29,541 to 30,240.

BAKER, F.—"Appliance for extinguishing or lowering gas, &c., applied to kettles, &c." No. 29,718.
BARCLAY, H. W.—"Gas-fires." No. 30,020.
BRADBURY, W. G.—"Gas-furnaces." No. 30,232.
CAMPANY, A.—"Coal and gas economizers." No. 29,823.
DUDDY, D. E.—"Atmospheric gas-heating apparatus." No. 29,799.
FRICKER, E. H.—"Burners of gas-fires, &c." No. 30,124.
GODFREY, W. H.—See Duddy, D. E. No. 29,799.
HARPER, W. T.—"Circular gas-rings." No. 29,969.
KIRKWOOD, C. A.—"Gas-heaters." No. 29,878.
MACHELL, R. J.—See Harper, W. T. No. 29,969.
MACKENZIE, M.—"Fractionating, distilling, or scrubbing column." No. 29,946.
NIEUWENBERG, C. J. VAN.—"Process for preparing thermo-resistant glassware." No. 29,884.
OLIVIER, G. P.—"Gas stoves and heaters." No. 29,859.
OUTWIN, E.—See Mackenzie, M. No. 29,946.
PEEBLES, W. C.—"Instrument for indicating heating quality of gas." No. 30,182.
READ, J. C. C.—See Duddy, D. E. No. 29,799.
SHAW, H. S. HELE—"Taps, valves, &c." No. 29,918.
SYLVESTER, J.—See Mackenzie, M. No. 29,946.
WIDLAKE, H. C.—"Automatically regulating pressure of gas-mains." No. 30,236.

APPLICATION FOR RESTORATION OF LAPSED PATENT.

Notice is given that FREDERICK WILLIAM GOLDBY has made application for the restoration of the patent granted to JOSEF MALY for an invention entitled "Improvements in or relating to gas generators," No. 4529 of 1908, dated Feb. 28.

The Bradford Window Cleaners' Association, at their recent annual dinner, voiced an opinion that the craft have a grievance against the Corporation in allowing numbers of lamplighters, who already have employment, to occupy their spare time in window cleaning, with the aid of Corporation tackle, thereby doing work which might make an honest living for some of those now in receipt of the unemployment dole.

LEGAL INTELLIGENCE.

CLAIM TO INCREASE FIXED CHARGES FOR GAS.

Royston Urban District Council v. Royston (Yorks.) and District Gas Company, Ltd.

This action, tried on the 8th and 9th instants, before Mr. Justice SARGANT, was brought to obtain a declaration that defendants were not entitled to supply gas to plaintiffs, or to other consumers within the township of Royston, otherwise than upon, and subject to, the terms and conditions of an agreement of March 8, 1904, and for an injunction restraining defendants from supplying gas at prices exceeding those prescribed and fixed by, and in accordance with, the agreement.

Prior to 1904, Royston (which has a population of about 6000 and a rateable value of £1200) was lit by oil lamps; but in that year a Mr. Henry Ellison laid before the Council a scheme for lighting the district by gas; and an agreement, dated March 8, 1904, was entered into. Thereby it was agreed that Ellison should, at his own expense, within four calendar months, construct, make, or lay down such retorts, gasholders, &c., in and adjacent to Royston, necessary for the supply of gas for the proper lighting of the streets as plaintiffs should require, and also for the supply of gas to private consumers, though nothing therein contained should make it obligatory upon plaintiffs to take gas for the purpose of street lighting or otherwise. The agreement provided that Ellison should supply gas of a quality or illuminating power equal in intensity to the light produced by not less than 15 sperm candles of six to the lb., and in all respects equal to that prescribed by the Gas-Works Clauses Act, 1871. Ellison had also, as and when required by the plaintiffs, to erect gas standards and lamps, and to maintain them. For gas supplied for public lighting the rate was not to exceed 3s. 6d. per 1000 c.ft., and to private consumers a sum not exceeding 4s. In the event of the profits exceeding a certain sum on the paid-up capital, the price of gas was to be reduced by 1d. per 1000 c.ft. Liberty was given to Ellison to assign the benefit of the agreement to a limited Company, and in March, 1904, the defendant Company was incorporated with a capital of £10,000, which was afterwards increased to £35,000; Ellison being appointed Chairman of the Company. Gas had been supplied by the Company on the terms of the agreement down to September, 1918, when the price was increased to 3s. 11½d. per 1000 c.ft. for public lighting, and to 4s. 2d. for private consumers. The Company claimed to be entitled to charge for the supply of gas sums in excess of the amounts prescribed by the agreement, notwithstanding that they were bound by the agreement; and as they threatened and intended to increase the prescribed charge, the present action was brought. Defendants pleaded that as a matter of law they were not bound to carry out the terms of the agreement in so far as they were binding on Ellison, and that the Council, if entitled at all to maintain the action, were not entitled to maintain the same on behalf of any person or corporation other than themselves. They further pleaded that, so far as the agreement related to the supply of gas otherwise than to streets, markets, and public buildings, it was *ultra vires* of the plaintiff Council, having regard to the provisions of the Public Health Act, 1875. The defendants did not admit that they had charged private consumers, other than the plaintiff Council, 4s. 2d. per 1000 c.ft., or that such consumers had paid this amount in ignorance of the alleged provisions of the agreement; and the charge made to slot consumers included not only the charge for the supply of gas, but a charge for the supply of slot meters, gas-fittings, and burners. Defendants further said that, even if the agreement was binding, the charges proposed to be made were, having regard to the great increase in the cost of materials and labour in consequence of the war (which increase could not be and was not foreseen at the date of the agreement), fair, just, and reasonable.

Mr. MACMORRAN, K.C., and Mr. ROOPE REEVE, K.C., appeared for the plaintiffs; Mr. GRANT, K.C., and Mr. J. G. WOOD for defendants.

During the hearing it was stated that if defendant Company could not increase their charges, they might have to close down, as they could not carry on business at a loss. The result would be that Royston would be without gas.

His LORDSHIP thereupon suggested that the case was one for a fair adjustment between the parties, as defendant Company, although not a statutory body, seemed to be entitled to some relief consequent upon the increase in wages and materials.

As a result of a conference, it was stated that the parties had come to an arrangement to increase the charges, which would have to be submitted to the Council for their approval.

His LORDSHIP accordingly ordered the case to stand-over generally, with liberty to apply to restore.

A Glasgow Corporation Residuals Contract.

The Corporation of Glasgow have just won a case in the Scottish Law Courts. Messrs. Brotherton & Co., of Leeds, who leased the Corporation chemical works attached to the gas-works at Provan, Glasgow, from October, 1904, to July 31, 1920, raised an action as to the construction of an article of the contract dealing with the price to be paid to the Corporation for the tar and ammoniacal liquor. The chemical works are now carried on by the Corporation under their own Manager. Lord Blackburn, in repelling the pleas in law of the pursuers, and assoilzing the Corporation, stated that it might be that Messrs. Brotherton, under war conditions, found themselves burdened by an unfortunate contract; but they did not take the steps available to them to end it. All the conclusions of their action at law were based upon an erroneous construction of the article.

An Electric Cable-Box Explosion.—In Brompton Road last Wednesday, the front of a shop was shattered, a dozen streets were plunged into darkness, and practically all the subscribers on the Kensington telephone exchange were disconnected by an explosion in an electric cable-box.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" regarding applications to the Board of Trade for Orders under the Gas Regulation Act.

Gloucester Gas Light Company.

The maximum price per therm proposed by the undertakers in substitution for the present price of 5s. per 1000 c.ft., in the urban district of Gloucester, is 18·6d. per therm; and for gas supplied beyond one mile from the city boundary 21d. per therm in substitution of the present price of 6s. per 1000 c.ft.

The Company also ask for the minimum permissible pressure in respect of the parishes of Barnwood, Hucclecote, Longford, Longlevens, Coney Hill, Saintbridge, and Churchdown to be, until Jan. 1, 1925, that prescribed by section 28 of the Gloucester Gas Light Company's Act, 1872.

SPECIAL ORDERS.

Southend Gas Company.

Notice is given by the Company of their intention to apply for a Special Order under section 10 of the Act to enable them to change the name of the Company to the Southend-on-Sea and District Gas Company; to confirm an agreement for the purchase of the gas undertaking of the Southend Corporation; to extend the limits within which the Company are authorized to supply gas, to include Leigh-on-Sea, part of the parishes of Eastwood and Little Stambridge, and the parishes of Ashingdon, Great Stambridge, and South Fambridge; to authorize them during a limited period to maintain gas-works and plant upon scheduled land at Leigh-on-Sea; to empower them to issue new stock; and to make provisions with regard to the supply of gas and the administration of the Company.

Swindon United Gas Company.

Application is to be made by the Company to the Board of Trade for a Special Order to authorize them to use additional lands scheduled for gas-works purposes; to pay an increased dividend on consolidated stock issued after the commencement of the Order; and to establish a profit-sharing scheme, benefit fund, and special purposes fund.

DECLARATIONS OF CALORIFIC POWER.

Draycott Gas Company.—500 B.Th.U. (Jan. 1, 1923.)
Long Eaton Gas Company.—500 B.Th.U. (Jan. 1, 1923.)
South Elmsall, South Kirkby, and North Elmsall Gas Company.—400 B.Th.U. (Jan. 1, 1923.)

BIRMINGHAM GAS DEPARTMENT UNVEILING.

Five War Memorial Tablets.

On Armistice Day, at 11 a.m., there was unveiled at each of the five works of the Birmingham Gas Department a bronze memorial tablet to the memory of the men who gave their lives in the war. Each works memorial bore the names of the men. The services were simple and most impressive, and were largely attended, as all work was suspended for half-an-hour.

Alderman J. H. Lloyd (the Chairman of the Gas Committee), who attended with Alderman Williams at the ceremony at the Windsor Street works, stated that the War Memorial Fund for the whole department, contributed by the employees through the General Welfare Fund, amounted to £1239; and, in addition, £915 was subscribed throughout the department for the Permanent War Memorial Fund, from which was defrayed the cost of the beautiful memorial in the central office at the Council House, and of the bronze tablets at the various works. The memorials had been placed there in order that those men who made the supreme sacrifice might not be forgotten.

Alderman T. O. Williams also spoke in similar terms.

The memorial at Windsor Street was unveiled by Mr. Frank Bluck (selected from, and by, ex-service men with pre-war service at the works). Then followed the two minutes' silence, after which the memorial was dedicated by the Rev. T. J. Bass (Vicar of St. Laurence's, Dartmouth Street, Birmingham). "The Last Post" was sounded, next "The Reveille," and the hymn "O God, our Help in Ages Past" was sung, and the National Anthem concluded the ceremony.

At Saltley the opening remarks were made by Alderman J. V. Stevens and Councillor Truscott (members of the Gas Committee); and the unveiling of the tablet was performed by Mr. C. Parker (an ex-service man). Alderman Stevens emphasized the urgent need of caring for the dependants of those who so nobly sacrificed themselves in the war. The Rev. W. Grome Merrilees blessed and dedicated the tablet; and the address was by the Rev. R. J. Bryant, who stated that those who gave their lives were really more alive in the true sense of the word now than when they were on earth. The ceremony concluded with Kipling's recessional hymn and the National Anthem.

At Adderley Street the unveiling ceremony was performed by Mr. W. F. Smith (an ex-service man), and Councillor Thornton delivered the opening address. The Rev. A. Farrington dedicated the memorial.

Alderman Gregory and Councillor Whitehouse attended at Nechells, where Mr. C. H. Budd (a naval ex-service man) unveiled the memorial; and it was dedicated by the Rev. A. E. Pickard.

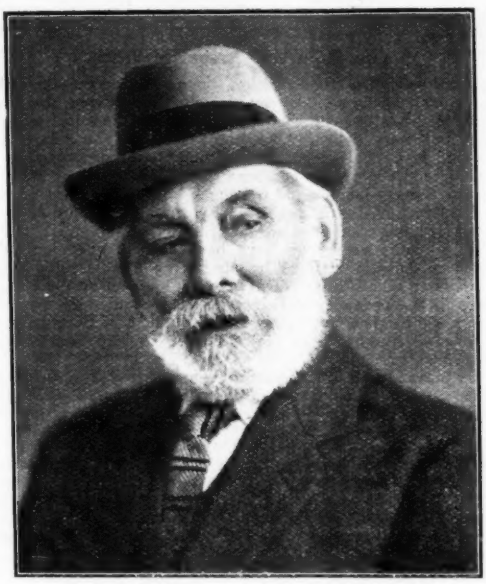
At Swan Village Alderman Sanders attended on behalf of the Gas Committee. The unveiling was performed by Mr. P. Millington (an ex-service man), and the Rev. John Goodacre (Chaplain to the Forces) dedicated the memorial, after which floral tributes were placed around it.

SEVENTY-FIVE YEARS' SERVICE AS A FITTER.

Is this a Record?

A remarkable record of service was revealed last week, when Mr. William Garlick, who is still able to follow his employment as a gas-fitter, reached his 89th birthday and the completion of 75 years' work with the York Gas Company. The occasion provided an opportunity for his fellow employees and the Directors of the Company to show their appreciation; and this they did by presenting to Mr. Garlick, on behalf of the Board, a wallet of Treasury notes, the official staff a portrait of the recipient, and the fitting staff a silver rose-bowl.

The ceremony was presided over by Mr. Alfred Procter (the Chairman of the Company), who said that Mr. Garlick had served under six Managers, and had always maintained the entire confidence and regard of the officials. After all these years of service, he was glad to say that Mr. Garlick was still going strong, and the Directors wished that he would continue to go strong. The Company had a singular record for the old and faithful service of their employees. Upon an occasion such as that, it was inevitable that they should lapse into a certain amount of reminiscence. When Mr. Garlick entered the service of the Company, gas was 6s. 8d. per 1000 c.ft. He lived to see it down to 2s. 1d., and to-day it was 3s. 7d. per 1000 c.ft. Mr. Garlick had also seen the number of consumers increase from 2000 to 22,000, and the consumption of gas increase from 28,000,000 c.ft. per annum to 657,000,000 c.ft. Those were significant figures, and showed the



MR. WILLIAM GARLICK.

[*Photo. by Catcheside, York.*

progress of the undertaking, which would shortly attain its centenary. Referring to the agitation in certain newspapers against the use of the therm, he said he gladly acknowledged that they had been fairly treated on all occasions by the newspapers circulating in the city. There was no doubt about it that there was no commodity which the public bought in which they were so well protected from over-charging as in the case of gas being sold by the therm. In conclusion, he mentioned that the Company would in the near future instal a new manufacturing plant.

The presentation of the portrait was made by Mr. J. Britton, who has himself been 63 years in the service of the Company. A replica of the portrait is to be hung in the fitting department, as a gift from the Board.

Stephenson Clarke & Co., Ltd.—A Company having this title has been registered, with a capital of £600,000 in £1 shares, to acquire the business of coal factors carried on by Messrs. Stephenson Clarke & Co., of No. 4, St. Dunstan's Alley, E.C. The subscribers are Col. S. R. Clarke, 133,680 shares; Mr. W. B. C. Clarke, 140,040 shares; Mr. S. H. Kent, 63,660 shares; Mr. F. G. Pilley, 70,020 shares; Mr. J. S. Hindley, 17,140 shares; and Mr. R. S. Clarke, 25,460 shares. No person other than the above is at any time to be admitted a member of the Company, except on certain conditions; and no shares in the original capital, beyond the above-mentioned 450,000, are to be issued without the sanction of a general meeting. The first Directors are the subscribers.

British Industries Fair, Birmingham.—The preliminary arrangements for the booking of space and stands at the British Industries Fair (Birmingham) for 1923, to be held from Feb. 19 to March 2, are rapidly nearing completion. British manufacturers have flocked very readily to assist by their active support in making the 1923 Fair bigger and better than any of its predecessors. A good British Industries Fair next year will undoubtedly reflect beneficially upon the work of the trades represented there, and thus upon the prosperity of the country as a whole. We understand that the Council of the Fair are prepared to consider a few more applications for space. These should be sent to the General Manager, British Industries Fair, Chamber of Commerce, Birmingham, who can deal with any other inquiries.

BRITISH SULPHATE OF AMMONIA FEDERATION, LTD.

Second Annual Report, for the Financial Year ended May 31, 1922.

The past year was the twenty-fifth year of propaganda work undertaken successively by the Sulphate of Ammonia Committee, the Association, and the Federation.

THE TURN OF THE TIDE.

In comparison with the previous year, the nitrogen market during the year under review has been free from violent fluctuations in supply and price. The credit for the improvement in the general position is undoubtedly due to sulphate of ammonia makers here and in America, who decided to meet buyers' wishes in regard to prices during the summer months, and were thus able to liquidate their stocks.

At the end of May, 1921, the combined unsold and apparently unsaleable stocks of British, American, and foreign sulphate of ammonia cannot have been far short of 200,000 tons, the bulk of which had been produced during a period of very high costs of production. Under normal conditions, and in view of the decrease in current British output due to the coal stoppage, it might have been possible to carry the stocks forward to the following consuming season, and to sell them at about their cost of production. But the risks involved in attempting to carry out such a policy appeared to the Executive Committee far to outweigh the possible advantages. Apart from the uncertainty as to whether America would be willing, or able, to act on similar lines, the danger of a collapse in nitrate of soda prices was only too apparent. On the one hand, the Chilean Government, beset with labour difficulties, were pressing the Nitrate Producers' Association to make fresh shipments; and, on the other, there were unsold stocks of 1½ million tons of nitrate in various parts of the world.

To continue to stock sulphate of ammonia with such a superabundant supply of nitrate available would have been to court disaster. The Executive Committee therefore decided to sell-off the stocks. Home prices were reduced to £13 3s. per ton; and after some weeks of negotiation, a level of price for export was reached at which the Japanese importers could compete with the sellers of local forms of nitrogen. Java, France, and Spain also began to buy, and in a few months the whole of the stock was liquidated. America had pursued a similar policy; and in the meantime a definite agreement had been arrived at between the Chilean Government, the Nitrate Producers' Association, and the "Pool" of European nitrate holders, by which a portion of the losses incurred by the "Pool" was to be made good. Prices for nitrate were reduced; and as sulphate of ammonia prices exhibited a steadily rising tendency, overseas buyers began to feel that the tide had turned.

British agricultural merchants were slower to appreciate the position. They were intimidated by the farmers' complaints and the volume of their unpaid bills. They were fearful of the result of the unofficial advice which was being given to farmers by some of the Farmers' Societies to withhold their orders in the hope of bringing about a reduction in prices. However successful this advice may have been in the case of other fertilizers, it was bound to fail with sulphate and nitrate, because prices had been reduced below cost of production or acquisition, and stocks were firmly held. Agricultural merchants therefore predicted a considerable falling-off in the home demand, some of them foreshadowing a reduction of 50 p.ct. The Committee budgeted for a decrease of 20 p.ct. on the previous year's figures, and this turned out a correct forecast, though the total deliveries would have been smaller if the season had not been cold and late.

Home deliveries showed a very marked falling off during the months August to December, 1921, in spite of the very low prices fixed; and the Committee therefore expected that the farmers would place their orders freely for January. They did not do so, however, and at that time it seemed possible that the home merchants' fears were going to prove justified. Added to this, came the disagreeable news from Spain that American brokers were offering large quantities freely for prompt and spring deliveries at prices lower than ours. The Committee therefore decided to accept orders for a moderate quantity for January-March delivery, so as to ensure an outlet for a portion of the future output. The American selling in Spain was due to the same causes which prompted the Federation's sales for export. The American fertilizer companies had their safes full of farmers' bills, some two years old, and their bins full of fertilizers. Early in February corn prices had dropped to such a level that farmers in the West and Middle West were burning corn as fuel. By the middle of March a complete change had taken place. Corn prices rose, the banks helped to melt the frozen credit, and the whole of the available supply of nitrogen in the United States was bought up to the end of April for home consumption.

In the meantime, a difficult situation arose in Great Britain. Farmers had been encouraged in their inclination to hold off till the last moment, by a small reduction in nitrate prices made early in February. But they had now received their subsidies from the Government, and finally decided to place their orders for sulphate of ammonia towards the end of February and early in March. The weather was fine, and the Federation were overwhelmed with orders for prompt delivery. It was inevitable that many farmers should be disappointed. They expected prompt delivery of a total quantity equal to at least three months' production; and when they found that the Federation had export contracts to fulfil, they were not slow to complain to the Ministry of Agriculture and demand prohibition of export. The Committee were able to convince the Ministry that the farmers had only themselves to thank for the temporary shortage, and took energetic steps to deliver every ton available—even postponing delivery of some of the export contracts. Fortunately the railway companies were able, owing to the general trade slump, to provide the necessary trucks and engines promptly; the weather turned and remained cold; and in the result, the Federation were able to cope fully with the home demand by the end of April. This demand continued uninterruptedly throughout May, and unusually large orders were received during the early part of June. Under these circumstances, it would have been easy for the Committee to raise the home price during March and April. But it was felt that it would be unfair and impolitic to attempt to exploit a temporary scarcity

to the farmers' detriment, and also that the price of £17 3s per ton for neutral quality which had been fixed, though lower than the parity of the nitrate price, was quite high enough in view of the financial difficulties of many farmers.

The correctness of this view appears to be borne out by the relatively small increase in the home deliveries of nitrate of soda, which are estimated at 55,000 tons, against 40,000 tons last season, and this in spite of the strenuous efforts made by the Nitrate Propaganda Committee to induce farmers to use nitrate instead of sulphate—efforts which included a newspaper advertisement, very complimentary to us, headed "Scarcity of Sulphate of Ammonia—Use Nitrate of Soda!"

Our propaganda staff received many encouraging proofs of the popularity of sulphate of ammonia among British farmers during this somewhat trying period. Many farmers said they would prefer to wait till the Federation could deliver, rather than buy nitrate.

PRICES AND COST OF PRODUCTION.

The conditions and events set out in the above brief retrospect were not of a character to encourage hopes of obtaining good prices; and, in point of fact, our average price for the year under review was about 40 p.ct. lower than for 1920-21.

While the selling price at the beginning of the season was probably considerably below cost of production at that time, there has been a continuous fall in wages, fuel, and raw material throughout the period. On the average, therefore, the selling price has probably left a bare margin on cost of production; but this, of course, means that at many of the smaller works production has either been carried on at a loss or ceased altogether.

A large reduction in the price of sulphuric acid has taken place. In June, 1920, the price was £5 to £7 per ton; whereas in May, 1922, supplies were obtainable in some districts at about £3 per ton. The last-named price is still about 100 p.ct. over the pre-war price, and will have to be greatly reduced if sulphate of ammonia makers are to adjust their cost of production to the level of the selling price for nitrogen, which may be expected in the not very distant future.

THE IMMEDIATE PROSPECT.

If the financial return for the year has been meagre, the Federation have at any rate prevented that total collapse in prices which has taken place in so many other commodities. The prospect for the coming season is encouraging. Nitrate of soda stocks have been reduced, and sulphate of ammonia stocks are non-existent, so that it seems reasonable to hope for a considerable advance on the average price for 1921-22.

While there will certainly be an increase in output in Great Britain due to the improving trade conditions, the American coal and railway strikes will reduce the quantity available for export from the United States; and it seems clear that Germany is unlikely to be able to produce more nitrogen than she can consume. Indeed, owing to the great explosion at Oppau in October, 1921, which entailed a loss of three months' production, and to subsequent difficulties of transport, Germany's supply of nitrogen for 1921-22 was not equal to her home demand, and about 20,000 tons of nitrate of soda were imported. Germany could, under present conditions, probably consume annually about 340,000 tons of pure nitrogen, equal to about 1,700,000 tons of sulphate of ammonia. Her production last season has been stated as 290,000 tons of pure nitrogen, and it is estimated that she will produce 320,000 tons during the coming season. We feel, therefore, that we can look forward to the coming season with considerable confidence.

THE REMOTER FUTURE.

We think it right to say a word of warning with regard to future years. In spite of the great success which has attended German and Norwegian efforts to produce synthetic nitrogen, other countries are only beginning to attack the problem. They will in time succeed in solving it; and as synthetic plants can apparently only be profitably worked on a very large scale, it is probable that in the course of the next ten years production will at times outrun consumption. Moreover, if the effect of the repayment of the British war debt to America is to cause a heavy fall in American wheat prices, Germany may again become an exporter of nitrogen on a large scale. Probably the mere possibility of synthetic output on a large scale will tend to bring nitrogen prices down to a lower level.

Now, the Federation have shown what efficient commercial organization can do in a time of crisis; but commercial organization, however good, cannot be a permanent substitute for technical efficiency in methods of production. Cost of production will remain the ultimate and decisive factor in international competition. Much can be done by fruitful conferences such as the Rotterdam meeting; but it will be the makers with the lowest cost of production who will attend and prevail at such conferences in the future.

We hope, therefore, that members will pay greatly increased attention to the question of reducing cost. This is a matter which is, strictly speaking, outside the province of the Federation. So was the production of neutral sulphate of ammonia. Nevertheless, it is due to our efforts, and to those of our predecessors during the last eight years, that the problem of producing neutral quality has received adequate attention from technical experts.

We suggest consideration of the problems of increasing the yield of ammonia per ton of coal carbonized, and of better control of, and economy in, the use of steam in the sulphate plant, as fruitful lines for inquiry. And we draw special attention to the research work on destruction of ammonia in the retort which is being carried out by Prof. Cobb at Leeds, and to the helpful work and advice of the Chief Inspector under the Alkali Act, and his assistants, in kindred matters. The consumption of lime in the sulphate plant should be watched, and loss of ammonia through waste liquor carefully guarded against.

OUR HOME AND EXPORT MARKETS.

The great reduction in production was due to the results of the coal stoppage early in 1921. For the reasons stated above, the home demand showed a falling-off of about 19 p.ct. as against last season; and 134,000 tons were delivered for home use. In the export market, France and Java, the Sugar Colonies, and Spain continued to be our best customers, while there has been a gratifying increase of consumption in the Canary Islands and Greece. The somewhat disappointing figure for Egypt is due in part to the prolonged period of unrest in that country; but conditions are now improving.

As in previous years, we have been able to effect considerable economy in delivery charges by chartering steamers for export to destinations to which liner rates were high. We applied the same principle in the case of our shipments to Ireland, and were able to ship from the English East Coast ports to North of Scotland ports at lower through freights than the railway rate from works in South Scotland.

We are pleased to be able to report a marked increase in the output of neutral quality. At the time of writing, over 50 p.ct. of the production is of neutral quality.

PROPAGANDA WORK.

This work has been continued under the general supervision of the Propaganda Sub-Committee, consisting of Messrs. A. Stanley (Chairman), S. Henshaw, and R. D. McCowan, who have held regular monthly meetings. The Federation's debt of gratitude to all these gentlemen steadily increases, and we wish that we could find terms to express thanks as adequate and varied as their labours have been. The executive part of the work has been under the capable direction of Mr. T. H. J. Carroll, who has displayed much resource and energy in his practical work, and written some excellent pamphlets setting forth sound agricultural doctrine in popular form. Three new Agricultural Advisers have been appointed, in accordance with the policy announced in our last report; but the Committee regret to report the resignation of Miss James, whose work at agricultural shows was particularly successful. It is a pleasure to report that all members of the propaganda staff have given satisfaction in their work—including Mr. J. Irwin, who had the unpleasant experience of being incarcerated in

TABLE I.—*Nitrogen Consumption Statistics.*

1921.	Population.	Total Arable Acreage.	Cereals.	Potatoes.	Roots, &c., including Cabbage, Legumes, Vetches, and Clover.	Actual Consumption of Pure Nitrogen.		Possible Consumption of Nitrogen.	
						Total.	Lbs. per Acre.	Total.	Lbs. per Acre.
			Acres.	Acres.	Acres.	Tons.		Tons.	
England and Wales	—	11,618,236	5,560,567	557,800	1,959,921	31,015	4·64	80,182	12
Scotland	—	3,349,067	1,247,527	153,820	—				
Ireland	—	2,492,049	1,480,214	568,081	—	4,310	3·87	13,350	12
Total—United Kingdom	45,000,000	17,459,352	8,288,308	1,279,711	437,967	35,325	4·53	93,532	12
		(1919 figures)			(Sugar Beet and Vineyards)				
France	40,000,000	54,406,209	26,087,399	3,590,508	4,153,919	48,960	2·01	291,461	12
Germany	65,000,000	£9,160,000	—	—	—	320,000	10·3	370,500	12

TABLE II.—*Cereals*, 1921.

United Kingdom.				France.				Germany.			
Acreage.		Produce.	Yield per Acre.	Acreage.		Produce.	Yield per Acre.	Acreage.		Produce.	Yield per Acre.
	Acres.	Quarters.	Bushels.		Acres.	Quarters.	Bushels.		Acres.	Quarters.	Bushels.
Wheat	2,084,100	9,224,000	= 35·4	Wheat	13,164,700	38,552,200	= 23·4	Wheat	3,560,900	13,475,000	= 30·3
Barley	1,781,800	6,762,000	= 30·4	Barley	1,652,400	4,535,300	= 22·0	Barley	2,808,400	10,686,900	= 30·4
Oats	4,413,400	20,594,000	= 37·3	Oats	8,294,700	25,142,500	= 24·2	Oats	7,814,100	35,365,800	= 36·2
				Rye	2,159,400	5,256,300	= 19·5	Rye	10,539,300	31,226,000	= 23·7
Total	8,279,300	36,580,000	= 35·3	Total	25,271,200	73,486,300	= 23·2	Total	24,722,700	90,753,700	= 29·3

Dundalk for three weeks by the Irish Irregular Forces. In order to secure greater unity of control and economy in administration, the Preston office has been closed, and the staff brought to London. We take the opportunity of thanking Mr. S. Tagg and the Preston Gas Company for the kindness and courtesy received at their hands.

The propaganda work has proceeded along the lines advocated in our last report. Chief attention has been paid to getting into personal touch with farmers at their farms, and at agricultural shows. Experiments on private farms, local competitions, and the distribution of literature have been valuable ancillaries. Newspaper and other advertisement has been used with circumspection. We have provided Rothamsted with the funds necessary to continue their special experiments, to determine the quantity of nitrogen per acre which can profitably be applied to cereals; and, in conjunction with the Fertilizer Manufacturers' Association, we are paying the salary of a guide-lecturer at Rothamsted, who shows parties of farmers over the plots. This innovation has been attended with very great success, and Sir John Russell informs us that they have had parties of farmers from all over the country four and five days a week. Owing to circumstances over which we had no control, the experiments at Hiam Farm, St. Ives (Hunts.), have only been moderately successful, but we expect better results in future. Negotiations have been opened with an important group of lime producers, with a view to conducting joint propaganda. The work in Egypt, the Canary Islands, and Spain has been based on the same principles, modified to suit local conditions.

That farmers require to be persuaded to use much more nitrogen is shown by the following figures giving the population, total arable acreage, and the quantity of pure nitrogen at present consumed in the countries named. In calculating the quantity which might be consumed as shown in the last column on the right, we have assumed a possible consumption of about ½ cwt. of sulphate of ammonia per acre of the arable acreage in each country. Scientific opinion certainly deems this within the bounds of possibility; but even if ample deduction is made for unfavourable conditions, the margin between what is used and what might be used is enormous.

The first table on p. 448 should be read in conjunction with the second table showing the yield per acre for cereals in the United Kingdom, France, and Germany.

MEMBERSHIP.

The Federation numbered, on June 1, 1922, 396 members—an increase of 6 over 1920-21—whose annual production represents slightly over 90 p.ct. of the total annual production in the United Kingdom.

ACCOUNTS.

There has been an increase of £2400 in the cost of administration proper; and whereas for 1920-21 the administrative expenditure worked out at about 1s. 0½d. per ton on members' production, on the reduced production for 1921-22 it has risen to about 1s. 10d. per ton. On the basis of the production of the preceding year, the expenditure for the year 1921-22 would have worked out at 1s. 2½d. per ton.

Our Auditors, Messrs. Thomson McLintock & Co., to whom we wish to express special thanks for the manner in which they have helped us to solve many difficult problems, offer themselves for re-election for the coming year.

D. MILNE WATSON, Chairman.

30, Grosvenor Gardens, London, S.W. 1, Nov. 1, 1922.

The Gas Poisoning Fatality at Stafford.

At the inquest on the mother and son who succumbed to gas poisoning in Backwalls North, Stafford, in circumstances briefly recorded last week [p. 382], it was stated that a 3-in. cast-iron main in the road outside the house had been newly fractured; there being no flaw in the pipe. The main was practically 3 ft. deep, which was considered quite sufficient. A steam-roller had been driven along the road the day before the escape was noticed, as had been the custom for some time. Mr. T. H. Poulson (the Corporation Gas Engineer and Manager) stated that the main in question was laid in a spongy soil, and gas would easily percolate through it. The sewer pipe also ran under the house in question, and escaping gas would follow the run of the pipe. The surface of the road being tar macadam, the gas would not rise, but escape sideways. He put the fracture down to heavy traffic and the soft soil in which the main was laid. He did not think it was due to the steam-roller. Heavy motor traffic would be more likely to cause the fracture, because the load was more distributed on steam-roller wheels than on heavily-laden motor-lorry wheels. If they were relaying the main there, they would probably put in a steel one, instead of cast-iron, owing to the nature of the sub-soil. Everything possible was done. The Jury, after a brief retirement, brought in a verdict in accordance with the medical evidence, and added that the two deaths were accidentally caused by the bursting of the gas-main due to heavy traffic. The Foreman said they wished to suggest to the Gas Committee that an inspection should be made of the gas-mains in other parts of the street. Alderman Young, on behalf of the Gas Committee, undertook that this should be done, and said that, if necessary, further steps would be taken. He expressed the deep sympathy of the Committee with the relatives and friends of the deceased, and said that arrangements would be made to meet the funeral expenses. The Coroner said he was very glad to hear this statement, and would convey it to the relatives of the deceased.

New Holder for Bangor (co. Down).—The Bangor (co. Down) Urban Council have adopted a report of the Gas Manager recommending the erection of a holder at a total cost, including excavation work, of £24,000.

Aldridge and Ranken, Ltd.—A private company has been registered, with a capital of £40,000 in £1 shares, to acquire the business of engineers carried on in Bath and London by Messrs. J. G. W. Aldridge and A. W. Ranken, as Aldridge and Ranken, and to carry on the business of mechanical, motor, electrical, and general engineers, ironfounders, manufacturers of machines for charging and discharging gas-retorts, machinery for use in gas-works, &c. The registered office is at No. 39, Victoria Street, Westminster.

ACCIDENT PREVENTION IN GAS-WORKS.

Some interesting facts with regard to the organized efforts on the part of all concerned at the works of the South Metropolitan Gas Company to reduce the percentage of accidents, were set forth by Mr. R. C. MACDONALD, in a paper (illustrated by lantern slides) which he read on Tuesday of last week before a meeting of the London Area Committee of the British Industrial "Safety First" Association.

Surmising that many of those present were not familiar with the operations carried on in a large gas-works, the author began by briefly describing the methods adopted at one of the stations of the South Metropolitan Gas Company. In the winter time at this works, when the plant is under full load, about 2400 tons of coal are carbonized in twenty-four hours. In addition to the ordinary gas manufacturing operations, large gas-engine driven centrifugal fans are provided near the outlet of the gasholders, to boost the gas to the up-river stations and to the outlying districts. The tar is drawn from the retort-houses by means of pumps, and delivered through a pipeline to the tar works. The ammoniacal liquor is similarly pumped to the chemical works. Most of the plant is working continuously, and therefore large repair shops are necessary to cope with its maintenance. Men of almost every trade are engaged on this work. Mr. Macdonald concluded his review by remarking that it would be sufficient to give some idea of the risks encountered from water, fire, gas, chemicals, railways, and machinery. These risks are not lessened by the fact that the work has to be carried out during the whole of the twenty-four hours, and that in the winter time, when the hours of darkness are greatest, the plant is operating at its highest pressure. In these circumstances it might reasonably be expected that the percentage of accidents would be large; but well-organized efforts on the part of all concerned could reduce this percentage, and make it compare favourably with some of the less hazardous trades.

Nearly 33 years ago, when the late Sir George Livesey introduced co-partnership, the workmen, through their representatives, were invited to assist in the good work of accident prevention, which had previously received much attention from the Board and management. In 1892 Sir George Livesey inaugurated his well-known system (which has now stood the test of thirty years, and has proved most efficient) of holding an inquiry into every accident, no matter how slight. According to the rules, as soon as possible after an accident has happened it is the duty of the chief officer in the department concerned to summon a jury of twelve workmen. The chief officer himself acts as president, and examines the witnesses. The jury also are invited to ask questions, and any plant or machinery involved is inspected by them. At the conclusion of the inquiry, the jury answer a set series of questions.

1.—Was the injury caused by accident arising in the course of the injured member's employment?
2.—Was the accident caused by any defect in the plant or materials used, and, if so, say what it was?
3.—Was there any mistake in the manner in which the work was done, and, if so, state it?
4.—Was the accident due to the negligence or want of care or foresight of any officer or foreman, and, if so, let the truth be known?
5.—Was the accident caused wholly or in part by any carelessness or negligence of the injured person or by that of any fellow worker, and, if so, let the truth be known?
6.—Was the accident attributable to the serious and wilful misconduct of the injured member, or any other person?
7.—Was it a pure accident, for which no one was to blame?
8.—Can anything be done to prevent a similar accident?

NOTE.—The prevention of accidents is the chief object. Therefore to give honest and true answers is a duty, and will do a kindness to all concerned, and will not penalize anyone except on Question 6.

The last question has proved a very useful one, and many valuable suggestions have been made by the jurors, which are always carefully considered by the management, and when practical are adopted. The jury's verdict is posted conspicuously on the works, and a summary of the proceedings is laid before the Board. The President of the Company presides at inquiries into fatal accidents; and a scale model of the scene of the occurrence is usually prepared. There is also provision for holding similar inquiries into accidents to, and breakdowns of, plant and machinery, even though no personal injury results.

When the Workmen's Compensation Act of 1897 came into operation, the Company were ready with a scheme certified under the Act, the provisions of which conferred benefits that were much more favourable than those prescribed by the Act; and under this scheme, again, the question of the injured person's qualification to benefit from the fund was decided by the jury of workmen. Contributions to the accident fund are entirely devoted to extra benefits; and in order to encourage and interest all members in the prevention of accidents, the contributions vary according to the number of accidents. For this purpose, each station is treated separately. When the accidents during the previous half year at any station fall below 55 per 1000, the contribution is halved; below 40 per 1000, it is reduced to one-third; and for no accidents, only one-sixth of the maximum contribution is required.

In the matter of results, Mr. Macdonald threw upon the screen a chart showing the percentage of accidents each year from the inception of the jury system. In 1898 it reached over 8 p.ct., by 1902 it was down almost to 5 p.ct., and in 1906 it was less than half the figure for 1898. There was a slight rise in 1907, and then it continued below 4 p.ct. until 1914, when strangers took the place of the men who flocked to the Colours, and the percentage of accidents began to rise again, until in 1917 it reached 7·9 p.ct. This showed what an important part the education of the individual worker plays in a safety organization, though the author admitted that the conditions under which the Company had to work during the war—and particularly the reduced lighting—contributed to some extent to the increase. The figure is now falling again. Mr. Macdonald went on to point out that the advantage of the jury system is that it promotes "Safety First" by exploring every means to prevent a recurrence of accidents; but, in addition to this, a direct attack is made by the Works Safety

Committee, who go round the works periodically with the specific object of finding out sources of danger, and suggesting remedies.

Much suffering and loss of time are prevented by the Company's excellent ambulance brigade, which forms No. 19 Division of the St. John Ambulance Brigade, enrolled in 1895. At the outbreak of war, the ambulance brigade also proved itself a distinct national asset, for within seven days 212 out of its 220 members were on active service. The strength of the Company's contribution to the brigade at present is 128; and in addition to this number there is a company of 14 women. First-aid classes are open to all employees, and inter-departmental competitions are held annually. About 2000 certificates have been gained in first-aid work, and efficiency in this class of work is one of the essential qualifications in candidates for posts of foremen. A few years ago the Directors provided three motor ambulances, which are stationed in central positions. Frequent applications by neighbouring firms are made for the use of these ambulances, and they are never refused.

METER TESTING IN EDINBURGH.

Mr. William Gordon, Official Inspector of Gas-Meters for the City of Edinburgh, in his report for the year ended May 15 last, says that the number of meters tested and examined during the twelve months was 73,272—3259 wet and 70,013 dry; and fees amounting to £3910 19s. 9d. were collected. The total number of meters tested by the department since its institution in 1861, up to and including May 15 last, was 3,273,775; the fees received for the same period being £97,784 6s. 9d. There are at present seven testing-stations under the jurisdiction of the Edinburgh Local Authority.

On March 1, 1921, the Gas-Meter Regulations, 1920, made by the Board of Trade under section 12 of the Gas Regulation Act, 1920, in relation to instruments for measuring gas, came into force. To meet the requirements, considerable alterations in the existing testing apparatus were required. The whole of the new apparatus was constructed according to the department's own specifications, and is giving complete satisfaction. Although the sum of £387 was expended as part cost of the new apparatus, the cash statement shows a profit on the year's work of £793 5s. 1d.

Tables accompanying the report contain the following figures.

—	Stamped.	Rejected as Incorrect.	Per Cent.
Total dry meters tested . . .	70,013	1,665	2·37
Total wet meters tested . . .	3,259	8	0·24
	73,272	1,673	—

PATENTING OF INVENTIONS.

The address of Dr. H. S. Hele-Shaw, F.R.S., as President of the Institution of Mechanical Engineers, which was delivered on Oct. 20, came in the year which is the seventy-fifth anniversary of the foundation of the Institution. It was therefore particularly appropriate that he should set before the members a brief review of some of the outstanding features of the Institution's advance, and give grounds for confident anticipations as to the future. But he did more than this, for a lengthy section of the address was devoted to the subject of scientific knowledge and invention.

This led Dr. Hele-Shaw to refer to patents. He said that the early engineer had to invent everything he wanted or used; but though that is all changed to-day, invention is just as vital to progress in mechanical engineering as it was in those old days—say, seventy-five years ago. Indeed, the stress of competition necessitates the more intense application of the inventive faculty; and an average of 30,000 patents is taken out each year by inventors searching for new devices and in the hope of securing some new results. Inasmuch as anything that has been patented within the previous fifty years (beyond which search is not conducted by the Patent Office) is considered as anticipated, it is easy to see what a hopeless task may be attempted by the ignorant and uneducated inventor. Anyone who studies the "Patent Journal" week by week must see that even to-day the attempts of a large number of inventors would be ludicrous if they were not in most cases pathetic. Over and over again the form of rotary engine, which for more than half-a-century has been well known to be quite inefficient, is produced and reproduced in various forms, with all its original defects. Futile inventions may be divided into two classes, the first being those in which the inventor seeks a result which is no use when he has attained it, and the second that in which an inventor is seeking the impossible—in fact, is following an *ignis fatuus*.

As to the patent law, the President remarked that certain matters had been suggested to him in which the Institution might use its influence. One of these concerns the revocation of a patent; another is designed to effect a clear understanding of the relation between employer and employee in matters of invention; a third relates to the rights of the Controller of Patents in regard to the power of refusing a patent for something which, though it may be new, is not in his opinion an actual invention; and, lastly, a proposal to introduce something sorely needed between a patent and a design, as provided for by the German patent law.

While a patent can be opposed on the grounds that the invention has been made public by some publication or other, you cannot oppose it on the ground that the invention has actually been made and sold. It ought to be possible, by proving to the Controller himself that such an invention has been actually made and sold, to give him the power to revoke a patent, or to oppose its being granted, whereas at present the only way of doing this is through the expensive proceedings of a High

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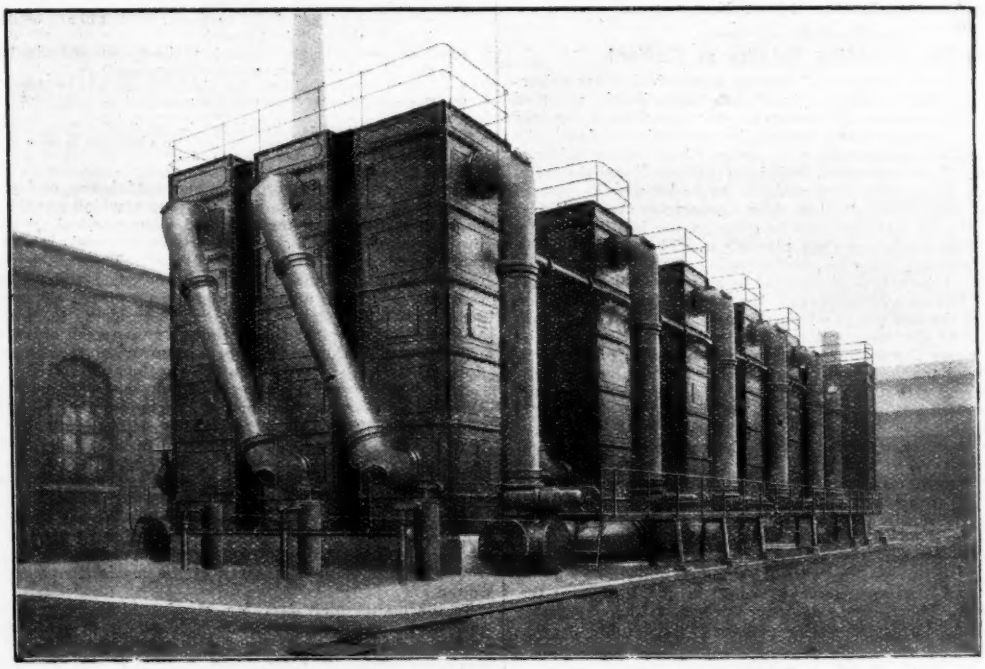

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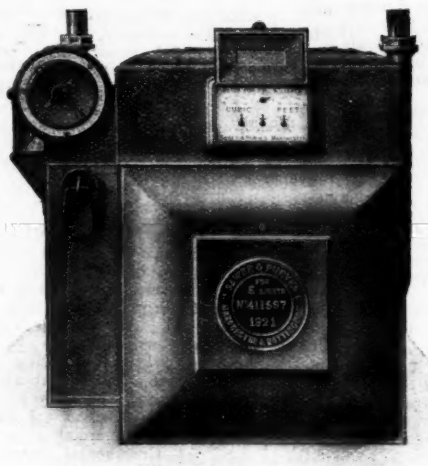

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Court. Apparently the Controller has no power whatever to receive evidence on the subject; so that he must remain officially in ignorance of something of which there may be abundant proof, even if it has not actually been published nor been the subject of a patent.

The second matter—namely, the relative rights of employer and employee—is a difficult one. It is usually met by some form of agreement which the employees are asked to sign. This is not fair to an employee. Under such an agreement an employee may make a valuable invention to which he then has no claim whatever. On the other hand, without such agreement the employer may be providing all the money and paying the time of his draughtsman, who may proceed to take out a patent himself for what he has arrived at while he has been paid by his employer to do this very work, and whose ideas he may have incorporated in his patent. It should be quite simple to have an equitable arrangement by which there must be some sort of Court of Appeal which could adjust the proper share in rights to each party in such cases.

Turning to the third matter, the Patent Office has power to refuse a patent on the grounds that it is not a new manufacture. At the present time this clause is being interpreted to mean that the Controller can refuse a patent on the ground that the subject-matter, while new, is not an actual invention, or as the patent law would put it, "not good subject-matter." Now the question of subject-matter being adequate or not should go through the Courts, with a final appeal to the House of Lords; but under the section the appeal is to a law officer who is Solicitor-General, and his decision is final. He is probably a busy man engaged far more in political than legal questions, and certainly not as a rule interested in patent matters.

Finally, to take a matter of great importance. To-day, when there is so little opportunity in mechanical engineering directions of far-reaching discovery, and consequently of a master patent, a cheaper patent for a short time (say, a period of five or six years) ought to be granted for an improvement which may be of great value, though the matter may be a comparatively small one. For this a small fee might be charged (say, £1 a year), enabling the inventor to introduce small improvements for which he would not receive adequate protection by registration of design, but which would be at once copied.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 13.

In the London market pitch remains the chief item of interest. There are anxious buyers; but supplies are short. The value continues to rise, and prices in the neighbourhood of 120s. per ton are freely bid. There is also a growing demand for creosote, and the price is firm at from 7¼d. to 7½d. per gallon net and naked. For solvent naphtha there is rather more demand, and the price is steady at round about 2s. per gallon net and naked at makers' works. Pure benzole and pure toluole are about 2s. 5d. to 2s. 6d. per gallon. In other products there is no change.

Tar Products in the Provinces.

Nov. 13.

The average values for gas-works products during last week were: Gas-works coal tar, 69s. to 74s. Pitch, East Coast, 117s. 6d. to 122s. 6d. f.o.b. West Coast—Manchester, 117s. 6d. to 120s.; Liverpool, 118s. 6d. to 121s.; Clyde, 120s. to 122s. 6d. Benzole 90 p.ct. North, 1s. 9d. to 1s. 10d.; crude 65 p.ct. at 120° C., 1s. 1½d. to 1s. 2½d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 10d. to 1s. 11d. Toluole, naked, North, 2s. to 2s. 3d. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 10d. Heavy naphtha, North, 2s. to 2s. 1d. Creosote, in bulk, North, liquid, 6¼d. to 6½d.; salty, 5¾d. to 6d. Scotland, 5d. to 5½d. Heavy oils, in bulk, North, 6½d. to 6¾d. Carbolic acid, 60 p.ct., 2s. to 2s. 1d. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

There is very little fresh to report in this market. Outputs are still on the small side; but with the reopening of blast-furnaces, and the consequent demand for coke, increased quantities of products will shortly be available. Meantime the demand for pitch is well maintained, especially from the Continent, and prices are still in the neighbourhood of £5 per ton; rather more being asked f.o.b. East Coast ports. Solvent naphtha is an improving market on the better outlook in the rubber manufacturing industries, and now quotes 2s. 6d. per gallon. Carbolic acid is showing a firmer front, particularly crystal 43's, which are now worth 7d. per lb.; but crude 60's remain at 2s. per gallon. Cresylic acid is practically unchanged, as also are benzole and creosote. Naphthalenes are dull, refined being quoted £16 10s. and crudes £4 10s. to £5 10s. per ton. Intermediate products are without any material change; there still being many inquiries from the Continent.

Sulphate of Ammonia.

The position here does not change. The demand continues from abroad, as well as from home users. No material increase in output is to be expected this year. On the other hand, a further price increase is to be looked for early in the new year.

High-Pressure Gas Lighting and Heating Company.—Under this title, and with a capital of £500, a company has been registered to carry on business as manufacturers of gas apparatus. The office is at Nos. 19-21, New Yard, Great Queen Street, London, W.C.

STOCK MARKET REPORT.

THE general tone of markets on the Stock Exchange last week was dull. Apprehension regarding the Turkish question and the persistent fall in Continental exchanges accounted for this. But Home Government issues closed practically unchanged. Home Rails weakened; but Argentines were firm. The Foreign Market gave way, but French and Turkish rallied before the close.

Business in the Gas Market was quite active and well distributed throughout the list, and the tone on the whole was satisfactory, although not all changes in quotation were for the better. The London Companies were firm generally, though Gas Light ordinary eased ½. In the Suburban and Provincial group, Bournemouth preference rose ½, Newcastle 5½, ditto debenture 1½, and Tottenham "B" 1; but Brentford "A" and "B" fell 1. In the Continentals, Imperial fell 1, and European 1; but Union preference rose 1. Primitivas were rather easier.

The following transactions in gas during the week were recorded: On Monday, Brentford "A" 102, European 10¼, 10⅛, 10⅜, 10⅝, Gas Light ordinary 95½, 95⅝, 95⅞, 96, ditto preference 78½, 79, Imperial Continental 156, 156¼, 156⅜, 157½, ditto 3½ p.ct. debenture 73½, 74½, Primitiva 11s. 9d., ditto 5 p.ct. preference 43s. 9d., 44s. 4½d., 45s., 46s., 46s. 3d., South Metropolitan 95, ditto 3 p.ct. debenture 61½, ditto 6½ p.ct. debenture 106, Tottenham "B" 100, Tuscan 2s. 6d., 2s. 7½d., Bournemouth 7 p.ct. debenture 101, Pinner 7 p.ct. 6 13/16, 6⅞. On Tuesday, Bombay 96s. 3d., 98s. 9d., Brentford "A" 101, 102, British 32, Croydon sliding-scale 93½, ditto max. div. 81, European 10⅜, Gas Light ordinary 95½, 95⅝, 95⅞, 96, ditto maximum 62½, ditto 4 p.ct. preference 79, 79½, ditto 3 p.ct. debenture 62, Imperial Continental 3½ p.ct. debenture 74, 74½, Liverpool 91½, Primitiva 11s. 6d., 13s., ditto 5 p.ct. preference 45s, South Metropolitan 95½, 95⅝, 96, ditto 3 p.ct. debenture 61½, South Suburban 98½, Tottenham "B" 100, Southgate 7 p.ct. maximum 104½, 105. On Wednesday, Bournemouth "B" 11, 11½, Brentford "A" 102, Brighton and Hove "A" 123½, Commercial 4 p.ct. 95½, ditto 3½ p.ct. 94½, ditto 3 p.ct. debenture 57, European 10, Gas Light ordinary 95, 95¼, 95⅜, 96, ditto maximum 62½, ditto 3 p.ct. debenture 62, 62½, 62⅝, Imperial Continental 156, Primitiva 12s., ditto 5 p.ct. preference 41s. 3d., 42s. 6d., 43s. 1½d., 45s., River Plate 4 p.ct. debenture 55, South Metropolitan 95, 95⅛, 95⅜, 96, ditto 6½ p.ct. debenture 105½, 106, South Suburban 98⅛, Tottenham "B" 100, Redhill 5 p.ct. "B" 69, 70. On Thursday, British 31½, ditto preference 10½, 10⅝, Commercial 4 p.ct. 94½, ditto 3½ p.ct. 94⅛, Continental Union 7 p.ct. preference 54, 55, Croydon sliding-scale 93½, 94⅛, European 9½, 9⅝, Gas Light ordinary 94⅜, 95, 95⅜, 95½, 95⅝, ditto maximum 62½, 62⅝, ditto 4 p.ct. preference 78½, ditto 3 p.ct. debenture 62, ditto 10 p.ct. bonds 192, Imperial Continental 155, Newcastle 78⅜, 79, Oriental 101, 101½, Primitiva 5 p.ct. preference 41s. 3d., South Metropolitan 95½, 95⅝, 96, Plymouth 7⅛ p.ct. 102, 102½, Uxbridge 5 p.ct. 85, 85½. On Friday, Bombay 95, Brentford "A" 100½, 101, ditto "B" 101, 101½, Croydon max. div. 80, European 9½, 9⅜, 9⅛, 9⅝, Gas Light ordinary 94⅜, 94⅞, 95, 95⅛, 95⅜, 95⅝, ditto 4 p.ct. preference 78¾, 79, 79½, 79⅝, ditto 3 p.ct. debenture 63, ditto 10 p.ct. bonds 191, 192, Imperial Continental 154½, ditto 3½ p.ct. debenture 74⅛, 74½, Lea Bridge 99, Oriental (exceptional) 97½, 97¾, Primitiva 5 p.ct. preference 40s. 6d., 42s. 6d., South Metropolitan 96, ditto 3 p.ct. debenture 61½, South Suburban 98½, Tottenham "B" 100½, 100⅝, 100⅞, 100⅞, ditto 6 p.ct. mortgage 99, 100, Hampton Court 5 p.ct. 94, 94½, 95, Colombo 7 9/16, Colonial 7 p.ct. preference 14s. 6d., 14s. 7½d.

In the Money Market, there was a strong demand, and rates hardened materially; but the close was easier. Discount terms were firm throughout. Silver fell steadily. The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Transactions.
£			p.c.					
182,049	Stk.	Aug. 24	4	4%	Aldershot 4 p.c. Pref.	..	68—73	...
1,551,868	,,	Oct. 5	2½	5%	Alliance & Dublin Ord.	59—64	62—67	...
374,000	,,	July 13	4	4%	Do. 4 p.c. Deb.	76—79	60—65	...
280,000	5	Oct. 19	7½	4/—	Bombay, Ltd.	5⅞—6⅛	4½—5	95/—98/9
100,000	5	Aug. 10	16	7½%		..	11—12	...
383,110	10	,,	7	7%	Bourne-mouth Gas and Water { B 7 p.c. ; Pref. 6 p.c. ; 4 p.c. Deb.	15—15½	10⅜—11⅛	11—11⅛
115,000	10	,,	6	6%		13⅛—14	8⅛—9⅛	...
162,065	—	June 29	—	4%		..	73—78	...
992,045	Stk.	July 27	14	6½/—	Brentford A Consolid.	261—266	100—103	100⅛—102
734,920	,,	,,	11	6½/3	Do. B New	204—209	100—103	101—101⅛
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	82—87	...
221,400	,,	June 15	4	4%	Do. 4 p.c. Deb.	91—93	75—80	...
214,775	,,	Aug. 24	11	11½%	Brighton & Hove Orig.	208—213	165—170	...
244,200		,,	8	8½%	Do. A Ord. Stk.	154—159	120—125	123⅛
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	..	..	
530,000	20	Oct. 5	12½	22/6	British	44—45	30—32	31⅛—32
120,000	Stk.	June 29	4	4%	Do. 4 p.c. Deb. Stk.	88—90	75—80	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	55—60	...
100,000	10	Nov. 2	—	7%	Cape Town & Dis., Ltd.	1⅛—2⅛	6⅞—7⅛%	...
100,000	10	Oct. 19	—	4½%	Do. 4½ p.c. Pref.	4—6	6—7	...
100,000	Stk.	June 29	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	73—78	...
100,000	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	...
157,150	,,	July 27	5/9/4	56/—	Commercial 4 p.c. Stk.	106—108	93—98	94⅛—95⅛
1,513,280	,,	,,	5⅛	55/—	Do. 3½ p.c. do.	103—105	93—98	94—94⅛
560,000	,,	,,	3	3%	Do. 3 p.c. Deb. Stk.	69⅛—71⅛	55—60	57
475,000	,,	June 15	3	—	Continental Union, Ltd.	76—79	29—34	...
800,000	,,	Dec. 15	4	—	Do. 7 p.c. Pref.	115—118	51—56	54—55
200,000	,,	,,	7	—	Croydon sliding scale.	..	90—95	93⅛—94⅛
660,000		Sept. 1	—	6%	Do. max. div.	..	78—82	80—81
284,975		,,	—	5%	Derby Con. Stk.	123—125	..	...
492,270	Stk.	,,	6	4½%	Do. Deb. Stk.	102—104	..	...
55,000	,,	,,	—	4%	European, Ltd.	17⅛—18	9⅛—10⅛	9⅛—10⅛
1,002,180	10	July 13	4	5%		98—102	94⅛—96⅛	94⅝—96
16,298,975	Stk.	July 27	4/17/4	52/—	Gas Light and Coke { 4 p.c. Ord. ; 3½ p.c. max. ; 4 p.c. Con. Pref. ; 3 p.c. Con. Deb. ; 10 p.c. Bonds ; 7½ p.c. Ilford Deb.	76—79	61—64	62⅛—62½
2,600,000	,,	,,	3½	35/—		96—99	76—81	78⅛—79⅛
4,062,235	,,	,,	4	4%		72½—74½	61—64	62—63
4,674,850	,,	June 15	3	3%		..	..	191—192
130,000	,,	Dec. 11	10	10%		..	..	...
	—	—	—	—		..	95—100	...
82,500	,,	Sept. 21	5	65/7½	Hastings & St. L. 5 p.c.	...	77—80	...
258,740	,,	,,	3½	50/7½	Do. 3½ p.c.	87—89	6—7	...
70,000	10	May 18	11	7½%	Hongkong & China, Ltd.	16½—16⅝	127—132	...
86,600	Stk.	Aug. 24	9	9½%	Hornsey 7 p.c.	..	155—160	154½—157½
1,976,000	,,	May 18	9	10%	Imperial Continental	150—160	71—76	73⅛—74⅛
404,800	,,	Aug. 10	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	95—100	99
235,242	,,	July 27	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	..	91½
2,498,903	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord.	..	87—92	...
165,736	,,	Aug. 10	7/5/6	87/3	Maidstone 5 p.c.	..	54—59	...
63,480	,,	June 29	—	3%	Do. 3 p.c. Deb	..	3⅛—3⅜	...
75,000	5	,,	6	6%	Malta & Mediterranean Met. of Melbourne 4½ p.c. Deb.	4⅛—4⅜	89—96	...
250,000	100	Oct. 2	4½	4½%		99—101	..	...
541,920	Stk.	June 1	4	4%	Monte Video, Ltd.	11⅛—12	62—67	...
1,875,892	,,	July 27	4½	4½%	Newcastle & Gatsh'dCon.	98⅛—99⅛	78—80	78⅛—79
529,705	,,	June 29	3½	3½%	Do. 3½ p.c. Deb.	82—83	68—70	...
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	..	..	...
55,940	10	Aug. 24	7/14/0	7/8⅝	,, 7 p.c.	14—15	10⅛—11⅛	...
300,000	Stk.	May 18	8	8%	Oriental, Ltd.	117—122	98—103	97½—101⅛
60,000	5	—	10	—	Ottoman, Ltd.	7⅛—7½	2—3	...
188,120	Stk.	June 29	—	6/3/9%	Plym'th & Stonh'se 5 p.c.	..	93—98	...
60,000	50	Aug. 24	13	65/—	Portsea Island, B	128—131	100—105	...
100,000	50	,,	12	60/—	Do. C	118—121	85—90	...
249,980	5	—	8	—	Primitiva Ord.	5⅛—6	16 16	11/6—13/—
499,960	5	—	5	—	Do. 5 p.c. Pref.	4⅛—5	2—2½	40/6—46/3
521,600	100	June 1	4	4%	Do. 4 p.c. Deb.	91—93	70—75	...
600,000	Stk.	July 27	4	4%	Do. ,, ,, 1911	..	55—60	...
346,198	,,	June 29	4	4%	River Plate 4 p.c. Deb.	85—87	55—60	55
150,000	10	Sept. 21	6	6%	San Paulo { 6 p.c. Pref. ; 5 p.c. Deb.	10½—11	5⅛—6	...
125,000	50	July 3	5	5%		47—49	35—38	...
135,000	Stk.	Aug. 24	10	5%	Sheffield A	223—224	97—99	...
209,984	,,	,,	10	5%	Do. B	222—224	97—99	...
523,500	,,	,,	10	5%	Do. C	220—222	97—99	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	..	..	...
90,000	10	Nov. 2	9	7%	South African	10½—11⅛	7—9*	...
6,609,895	Stk.	July 27	5/4/0	5%	South Met. Ord.	111—113	94⅛—96⅛	95—96
250,000	,,	July 13	—	5%	Do. Red. Pref.	..	94—96	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72⅛—74⅛	61—64	61⅛—61⅞
224,820	,,	Aug. 24	8½	8½%	South Shields Con. Stk.	157—159	106—108	...
1,087,795	,,	,,	6	6%	S'th Suburb'n Ord. 5 p.c.	114—116	97—100	98½
368,837	,,	June 15	5	5%	Do. 5 p.c. Deb. Stk.	116—118	95—100	...
647,740	,,	Nov. 2	5	7%	Southampton Ord.	99—102	77—82*	...
121,275	,,	June 29	4	4%	Do. 4 p.c. Deb. Stk.	..	63—68	...
120,000	,,	July 27	—	7½%	Tottenham { A 5 p.c. ; B 3½ p.c. ; 4 p.c. Deb.	135—138	112—117	...
782,275	,,	,,	6	6%		115—117	100—103	100—100⅜
181,255	,,	June 15	4	4%		87—89	75—80	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	⅛—⅜	2/6—2/7½
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	20—30	...
236,476	Stk.	Aug. 24	5	2½%	Tynemouth 5 p.c. max.	108½—109	79—81	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	July 27	8½	72/6	Wandsworth A 5 p.c.	151—156	111—115	...
255,636	,,	,,	6½	57/6	Do. B 3½ p.c.	129—134	95—100	...
128,075	,,	,,	—	50/9	Do. C.	..	87—92	...
140 865	,,	,,	—	50/9	New Ordinary	..	87—92	...
352,000	,,	,,	6½	53/9	Wimbledon 5 p.c.	117—122	95—100	...
98,000	,,	,,	6½	58/9	Epsom 5 p.c.	121—126	95—100	...
88,416	,,	June 29	3	3%	3 p.c Deb. Stk.	66—69	57—60	...

* Ex Div.

SHARES FOR SALE.

To Capitalists, Investors, and others.

IMPORTANT SALE OF GAS STOCK.

NORTHAMPTON GASLIGHT CO.

WOODS & Co. will offer for Sale by Auction, under the provisions of the Northampton Gas Act, 1919, at the Company's Demonstration Room, Wellington Street, Northampton, on Wednesday, November 29th, 1922, at 2.15 in the afternoon punctually,

£40,000 CONSOLIDATED STOCK,

to form one Stock with the existing Consolidated Stock called the NORTHAMPTON GAS CONSOLIDATED STOCK, in Lots of £100 each (nominal value of Stock).

NOTE.—The Company has paid each year since the conversion of the former shares of the Company into Stock in May, 1905, a dividend of 5 p.ct. per annum (maximum rate allowed) on the Consolidated Stock issued.

For further Particulars and for printed Conditions of Sale, apply to the AUCTIONEERS, 16, ST. GILES' STREET, NORTHAMPTON, or of MESSRS. DENNIS FAULKNER & ALSOP, Solicitors, 17, MARKET SQUARE, NORTHAMPTON, or the SECRETARY of the COMPANY, ABINGTON STREET, NORTHAMPTON, MESSRS. G. S. HERBERT & SONS, Stockbrokers, 76, CORNHILL, LONDON, E.C.3, MESSRS. SWANNELL & BROWN, Stockbrokers, GEORGE ROW CHAMBERS, NORTHAMPTON, MESSRS. CAVE & SONS, Stockbrokers, FISH STREET, NORTHAMPTON.

Demy 4to. Limp Cloth. Price 10s. 6d.

THE FLOW OF GASES and PROPORTIONING GAS MAINS.

By

F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.

WALTER KING, LTD., "GAS JOURNAL" OFFICES, 1, Bolt Court, FLEET STREET, E.C.4.

TRADE NOTES.

"Wireless Cookery."

We have seen a very smart and topical advertisement in the form of a post-card circulated by Messrs. John Wright & Co., of Birmingham. It depicts, very humorously, the effects caused in the kitchen by an amateur wireless enthusiast, who "earthed" his receiver to the gas-pipe instead of the water-pipe.

"Arkon" Specialities at the Cardiff Engineering Exhibition.

Messrs. Walker, Crosweller, & Co., of Dane's Inn House, of 265, Strand, London, W.C. 2, inform us that they have a stand at the Engineering Exhibition at Cardiff, which will open on Monday next, the 20th inst., and continue until the 25th inst. inclusive. They will show several of their "Arkon" Gas Analysis Recorders, including their Oxygen Recorders, and also a wide range of "Arkon" Indicating and Recording Draught and Pressure Gauges, with their well-known Full-Scale Gauges.

A Shop Lighting Catalogue.

Bearing a striking illustration on the front cover, and headed "Good Lighting Brings Good Business," Messrs. J. & W. B. Smith, Ltd., of 15 to 23, Farringdon Road, E.C. 1, have just issued a Special Shop Lighting Supplement to their general catalogue, with up-to-date prices. Glancing through its pages, it would appear from the variety of lamps and fittings shown therein that the firm are in a position to supply the requirements for every description of shop lighting, both indoor and outdoor. While space will not permit of a notice of all the varieties of lamps shown, special mention may be made of the firm's well-known "Silva" lamp, an important feature of which is the fact that, by simply removing the gas adjusters outside the casing, the burners can be readily cleaned without disturbing any other part of the lamp. This type of lamp is also supplied fitted with the latest superheater box. It is pointed out that careful consideration has been given to the question of maintenance, and any part can be replaced at normal cost. While the firm's name and discount rates appear on the bottom corner of the cover, this portion may be torn-off without in any way detracting from the appearance of the "Supplement."

Welsbach Catalogues.

The season 1922-23 general catalogue (No. 400) of the Welsbach Light Company, Ltd., of 344-354, Gray's Inn Road, London, W.C., is an elaborate cloth-bound book, to which they have attached the title of "The Encyclopedia of the Gas Trade." It is indeed a complete and admirably arranged list of up-to-date lighting fittings for every purpose, including, as it does, a mantle section, a burner section, a glass section, a fittings section, a lamp section, a radiator, gas-ring, griller, and geyser section, and a small sundries section. A separate slip contains the welcome intimation that, owing to the imposition of a duty on gas-mantles imported from Germany, all mantle prices in the catalogue have now been reduced. Revised price-lists are in course of preparation, and will be forwarded on request. Welsbach mantles have always been British made. We have also received from the Company a catalogue of the new season's Welsbach-Kern gas-radiators, giving illustrated particulars of these well-known heating appliances, which are made in a number of different styles.

Type Metal Melting.

Bulletin No. 7 of British Furnaces, Ltd., Derby Road, Chesterfield, describes certain standard types of surface combustion furnaces and burner equipment for soft metal melting, which they claim ensure the attainment of the three aims of prime importance in the melting of metals—namely, rapidity of production, economy of fuel, and easy control of temperature. It is frequently found possible to remodel at comparatively small expense an existing furnace, which would give results closely approximating those obtained by a complete new installation. Recent tests taken on a converted furnace at one of the largest firms of publishers in the country show that the gas consumption has been reduced by more than one-half, and the time taken to heat-up the furnace from cold and melt 6 cwt. of type metal has been reduced from 1¾ hours to 40 minutes. In fact, the engineer concerned estimates that the saving in gas alone will pay for the equipment in three months. It may be pointed out that the furnaces work with a mixture of gas and air in combining proportions, and utilize to the maximum extent the many advantages of radiant heating. Absence of flame in the combustion chamber materially increases the life of pots. An important feature is the single valve control, by means of which a perfect mixture is always obtained automatically by the operator at any rate of working. The system is such that the furnaces can be relied upon to reproduce exactly the same temperature and the same quality of metal, day in and day out.

While employed repairing the roof of a purifier-house at the Dundee Gas-Works, Alexander Costello, a slater, fell to the ground, a distance of about 30 ft., and sustained such severe injuries that he died on the way to the infirmary.

Messrs. R. & A. Main, Ltd., have removed their London showrooms from No. 25, Princes Street, Oxford Circus, W., to No. 38, Grosvenor Gardens, S.W. 1. The new premises will be open for business during the next two weeks. Meanwhile, showroom communications should be sent to the head offices, Gothic Works, Angel Road, Edmonton, N. 18.

The issue of new capital which Messrs. A. & W. Richards have just made for the Welwyn, Knebworth, and District Gas Company, Ltd., in the form of debentures and ordinary shares, was considerably over-subscribed. For the £1000 debenture stock, the tenders sent in amounted to over £8000; while for the 400 £10 new ordinary shares the tenders ranged from £13 10s. down to the minimum of £12 10s.—those at the latter price securing partial allotment only.

The Federation of British Industries have decided to inaugurate a British Section at the Canadian National Exhibition to be held at Toronto next year. Founded in 1879, the exhibition has been held annually ever since, with a regular increase both in size and in the number of visitors. It now attracts during its fortnight's run an average of about 100,000 visitors per day. Though a few British manufacturers have for many years been in the habit of exhibiting, with marked success, the bulk of the manufactured goods have been either of Canadian or American origin; and it is felt that the participation of United Kingdom firms should be very much greater, in view of the opportunities for British business in Canada which exist at the present time. Realizing that one of the obstacles confronting British firms is the distance from England to Canada, and the expense and trouble necessitated in arranging an individual exhibit, a scheme has been prepared in which the Federation will undertake all the preliminary work. An adequate block of space in one of the principal buildings is being held at the option of the Federation of British Industries, whose address is No. 39, St. James's Street, London, S.W. 1.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON TUESDAY, to ensure insertion in the following day's issue.

Orders to Alter or Stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Monday.

UNDISPLAYED ADVERTISEMENTS: Situations Wanted, Six Lines and under (about 36 words) 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum, 4s. 6d.

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All Communications, Remittances, &c., to be addressed to WALTER KING, LIMITED, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

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J. E. C. LORD (Manchester), Ltd., Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.

WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.

REPAIRS RECEIVE PROMPT ATTENTION.

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We Guarantee promptness with efficiency for Repairs.

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BALE & CHURCH, LTD. 33, ST. MARY AT HILL, LONDON, E.C.3. Phone: Minories 1484.

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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.

SPENSER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.,
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Telegrams—"HYDROCHLORIC, FEN, LONDON."
Telephone—1588 AVENUE (3 lines).

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Advice and Handbook free. 35 years' references. Gas Patents a Speciality. KING'S PATENT AGENCY, Ltd. (Director, B. T. King, A.I.M.E., British and U.S. Regd. Patent Agent), 146a, QUEEN VICTORIA STREET, LONDON, E.C. 4.

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COMBINED, AND SELF CONTAINED WATER AND COAL GAS PLANT.

CAPACITY, 100,000 c.ft. to 1,000,000 c.ft. per day.

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Telegrams & Cables: "MOREGASYN LONDON."
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PENNINGTONS ENGINEERING TUTORS, 254, Oxford Road, MANCHESTER.

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Telegrams: Canal, Brentford. 'Phone: Ealing 17.

TAR WANTED.

BEFORE entering into any arrangement for the DISPOSAL of your Production it will be to your interest to communicate with

BROWNHILLS CHEMICAL WORKS CO.,
near WALSALL.

TULLY GAS PLANTS, LTD.,
MILLGATE, NEWARK-ON-TRENT.

SOLE Makers of Tully's Patent Gasification PLANT. Specialists in Tar Extractors, Coal Elevators and Conveyors, Hoppers, Bunkers, T.G.P. Fire Cement, Castings.
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Telephone No.: 174 NEWARK.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for Gas-Works.
ANDREW STEPHENSON, Gresham House, Old Broad Street, LONDON, E.C. "Volcanism, London."

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CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70 & 72, Chancery Lane, London, W.C. 2.
Telegrams: "Patent, London." Phone 243 Holborn.
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ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON,
SPENT OXIDE BOUGHT.

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SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement Sept. 8, p. 548.

WANTED.

TAR, Light Oils, Crude Benzole and NAPHTHAS,
For which we are prepared to pay Good Prices.
FREDK. G. HOLMES & CO., LTD.,
THAMES TAR WORKS, NORTHFLEET, KENT.

APPOINTMENTS, &c., VACANT.

WHEN Filling Vacancies, please REMEMBER THE CLAIM OF THE EX-SERVICE MAN, who, other Qualifications being equal, has the FIRST CALL ON YOUR CONSIDERATION.

COUNTY BOROUGH OF BIRKENHEAD.
(GAS UNDERTAKING.)

THE Birkenhead Corporation Gas Committee require the services of a CHIEF CHEMIST to Take Charge of the Laboratory, Sulphate of Ammonia Plant, and other Chemical Plant.

Candidates must be properly trained Chemists, competent to carry out all Gas-Works Tests. They must also have sufficient Experience and Knowledge of Gas Manufacture to be able to Assist in the supervision of the Works Plant.

Preference will be given to Candidates with Experience of Sulphate of Ammonia Manufacture.

Applications, with *copies* of Testimonials, to be sent to the undersigned not later than Monday, the 20th of November, giving details of experience and stating salary required.

J. FEARNLEY,
Town Clerk.

Town Hall,
Birkenhead,
Oct. 31, 1922.

JUNIOR ASSISTANT ENGINEER.

THE Cardiff Gas Light and Coke Company require the services of a Young and Well-Trained Assistant at the Grangetown Gas-Works. Age 25 to 30. Commencing Salary, £350 per Annum.

Particulars may be obtained from the undersigned. Canvassing will disqualify.

GEORGE CLARRY,
General Manager and Secretary.

Gas Offices,
Bute Terrace,
Cardiff,
Nov. 4, 1922.

GAS-WORKS Manager to Take Charge of Works up to make of 150 million cubic feet. Must have had practical Experience in Carbonizing, Stoking Machinery, Carburetted Water-Gas Plant, necessary Chemical and all other Tests, and keeping of Records, Books, &c. Good Control of Workmen essential. Age between 30 and 45 years. Salary £350, without Residence.

Applications, with Three recent Testimonials, to be sent to Messrs. WOOD, DREW, & Co., 139, CANNON STREET, LONDON, E.C.

SENIOR Chemist required for Bye-PRODUCT COKE-OVENS and CHEMICAL WORKS, Ammonia, Benzole, and Tar Distillery. Must have University Degree in Chemistry. Preference given to Applicants who have had previous Experience.

House provided. Please state Age and Salary required. *Copies* only of Three Testimonials to be supplied.

Apply No. 7218, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

WANTED—Young Man as Technical and General Assistant on a 150 Million Works—South East Coast town. Must understand Gaseous Firing and the adjustment of Generator Settings, and be capable of carrying out all usual Works Tests.

Applications, with *copies* of Testimonials, stating Age, Qualifications, and Wages required to No. 7219, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

WANTED — Experienced Man to Undertake MAINTENANCE WORK in all Branches. Must understand all kinds of Lighting Burners, Cookers, Fires, Hot Water Circulators, &c. Wages, £3 10s. per Week.

Apply, in writing, with *copies* of References, by Nov. 22, to ARTHUR W. SUMNER, Engineer and Manager, GAS-WORKS, GRAYS, ESSEX.

PLANT, &c., FOR SALE & WANTED

FIRTH BLAKELEY, SONS, & CO. Ltd., Church Fenton, Leeds, have the following GAS PLANT AT BARGAIN PRICES:

WATER TUBE CONDENSER, 20,000 c.ft. per day, 14 in. Connections.
ANNULAR CONDENSERS. Set of Four nearly new, 12 in. connections.
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CAST-IRON TOWER SCRUBBERS, 5 ft. dia. by 40 ft. and 4 ft. 6 in. dia. by 18 ft. high.
WRT.-IRON TOWER SCRUBBER, 4 ft. 6 in. dia. by 36 ft. high.
LIVESEY WASHERS, 750,000 c.ft. per day and 100,000 c.ft. per day.
PURIFIERS. Set of four 25 ft. square, perfect.
PURIFIERS. Set of Two 12 ft. square, and Two 9 ft. square.
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TANKS, numerous stock all sizes.
PUMPS, Steam and Belt Driven.
Low Prices accepted for Quick Sale.
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CHURCH FENTON, YORKS.

COUNTY OF LANARK.
DISTRICT OF THE MIDDLE WARD.

OWING to the partial Closing-Down of Bellshill Gas-Works, the Middle Ward District Committee of the County of Lanark have the following GAS-WORKS PLANT FOR DISPOSAL:

HYDRAULIC MAINS, 6 in. ASCENSION, BRIDGE, and DIP PIPES, 21 in. by 15 in. MOUTHPIECES, and other BENCH MOUNTINGS for five Settings of Seven Retorts, with TAR TOWER and 12 in. Connections.
One Set of Four ANNULAR CONDENSERS, size 3 ft. 6 in. diameter by 30 ft. high, capable of dealing with 500,000 cubic feet per day, with 12 in. Inlet, Outlet, and Bye-Pass Valves and Connections.
One HOLMES ROTARY SCRUBBER for 500,000 c.ft. per day, with HORIZONTAL STEAM-ENGINE and 12 in. Connections.

The Plant can be inspected at Bellshill Gas-Works, and further Particulars obtained there.

Offers for the whole or any part of the Plant should be sent to the Subscriber not later than the 23rd of November current.

W. E. WHYTE,
District Clerk.

District Offices,
Hamilton.

TURBO Alternators—Two 100 k.w. H.P. Three Stage 440 volt, 3000 r.p.m. Three-phase 50 Cycle British Thomson-Houston TURBO ALTERNATORS, with direct Connected Exciters and Oil Relay Governors, Complete with Oil Draining Pipes and Valves in Excellent Condition.

ALSO Low Tension Switch board and Tirrell Regulator.

Full Specification on Application to A. W. SMITH, General Manager and Secretary, CITY OF BIRMINGHAM GAS DEPARTMENT.

FOR SALE—
STEEL STRUCTURE, 252 ft. by 64 ft. by 40 ft. to Eaves.
Five New STEEL BOILER TANKS, 30 ft. by 10 ft. diameter.
Two CIRCULAR TANKS, flat ends, 11 ft. 6 in. high, 9 ft. 6 in. diameter, ½ in. Plate, with Removable Lids.
Two CIRCULAR TANKS, 12 ft. diameter by 3 ft. 2 in. deep, ⅜ in. Plate.
Two RECTANGULAR Closed Top TANKS, 19 ft. 6 in. by 8 ft. by 8 ft.
Three Partly Closed, 12 ft. by 7 ft., 10 ft. by 5 ft. 6 in., ¼ plate.
One BOILER TANK, 30 ft. by 7 ft.
One BOILER TANK, 30 ft. by 6 ft. 6 in.

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FOR SALE—250,000 C.Ft. Capacity GASHOLDER and STEEL TANK, Equal to New. First-Class Condition. Cheap, to save taking into stock.

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FOR SALE, in Good Condition, Sul-PHATE OF AMMONIA STILLS (Free and Fixed Ammonia)—Capacity One Ton Sulphate per day. Low Price.

Apply to the GENERAL MANAGER, GAS COMPANY, COLCHESTER.

RAILWAY Tank Wagons for Disposal, Rectangular and Cylindrical, specially suitable for Oil, Inflammable Liquids, also Acids. Inquiries invited.

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STEAM-BOILERS—All Sizes, Vertical, Loco-type, Cornish, Portable, and Other Types of Boilers.

Apply GRANTHAM BOILER & CRANK Co., LTD., GRANTHAM.

FOR SALE - Equal to New.
1 Gasholder and Steel Tank—20,000 c.ft. capacity.
1 Gasholder and Steel Tank—11,000 c.ft. capacity.
1 Gasholder and Steel Tank—9,000 c.ft. capacity.
1 Steel Tank 31 ft. 6 in. by 15 ft. 3 in. deep.
1 Steel Tank 29 ft. 6 in. by 12 ft. 3 in. deep.

J. BATES & SONS, Gas Engineers, WIGSTON LANE AYLESTONE, LEICESTER.

Continued on p. 456.